In This Issue *New Advances in Fuel Oil Economy, in Rate Regulating and in Other Matters of Vital Interest to Engineers of the West*

JUL 23 1917

JOURNAL OF ELECTRICITY

VOL. XXXIX NO. 2 SAN FRANCISCO, JULY 15, 1917 PER COPY, 25 CENTS

A Half Million Horsepower on the Columbia—a Typical Instance of Possible Power Development in the West

The West is Prepared—

With its ten million horsepower properly developed, the West could supply sufficient energy in A SINGLE DAY to transport the Kaiser and a thousand of his much vaunted Prussian leaders to the surface of the moon and still work with less than fifty per cent efficiency. It could then supply power to pump food, air and water to this place of isolation and yet reserve sufficient energy to drive the industrial wheels of an empire.

PERIODICAL DIVISION

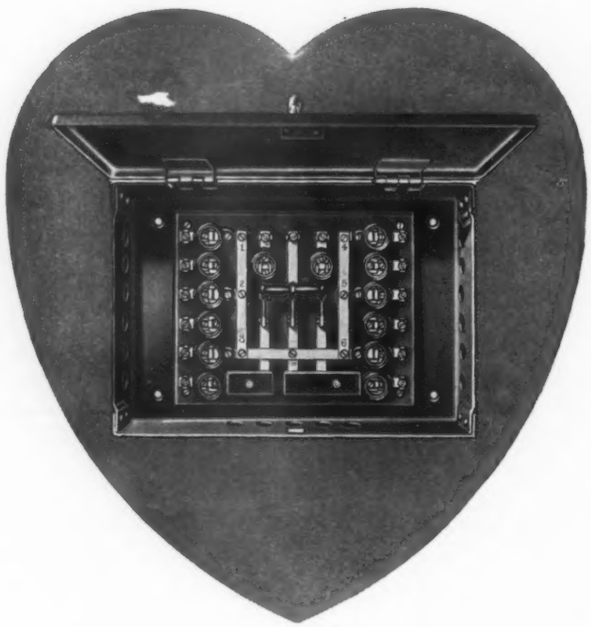
But coming back to earth—

The eight states west of the Rocky Mountains as shown on the map herewith comprise nearly one-fourth of the total area of the United States, have but six per cent of the total population of the United States and yet they have developed more than one-third of the total hydroelectric power of the nation. Over two-thirds of a billion dollars have been invested here in central station construction and equipment. In no other section of the country is electric power available at lower rates or is it used more widely per capita of population. Ten million horsepower are today thwarted in development and are going to waste even though the industries of the nation are crying for conservation of fuel.

CAN'T YOU DO SOMETHING to urge upon Congress the necessity of reasonably encouraging the still further development of the splendid water powers of the West?

"The Heart of Home Wiring"

Crouse-Hinds Residence Panels



Safety, Efficiency, Durability, Economy

For 1 or 2 Meter Connections and for 1 to 10 Circuits.

Meter Loops can be sealed to prevent theft of current.

Same workmanship and materials which have made Crouse-Hinds Panels and Cabinets the Standards.

Complete Details and Listings in Bulletin No. 1B—
Yours for the Asking.

CROUSE-HINDS COMPANY

SYRACUSE, N. Y., U. S. A.

NEW YORK BOSTON CHICAGO

JUL 23 1917

©CLB392592

JOURNAL OF ELECTRICITY

Devoted to the Generation, Distribution and Utilization of Energy

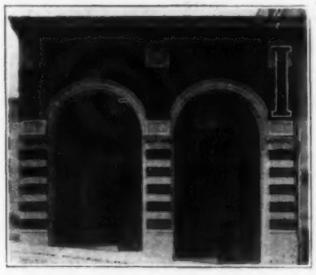
VOLUME XXXIX SAN FRANCISCO, JULY 15, 1917 NUMBER 2

[COPYRIGHT 1917 BY TECHNICAL PUBLISHING COMPANY]

A NEW ADVANCE IN FUEL OIL ECONOMY

BY C. D. STEWART

(New ideas in central station endeavor are constantly being put forth throughout the West that vastly forward the economic production of steam auxiliary electric power. Here is a description of a striking feature of the new Bush street station of the Great Western Power Company in San Francisco that should interest all those who have to do with the generation of steam by means of fuel oil. Economy in the use of fuel oil is of first importance in these days of national stress. As to how this is effected in this new installation by the careful automatic regulation of the oil, the ash pit opening and the damper control, the reader will find out in the following lines. The author is chief engineer for the company that has made the installation for the Great Western Power Company.—The Editor.)



The Bush Street Station of the Great Western Power Co

IN providing a steam stand-by plant for service on a hydroelectric line, one of the important points for consideration is reducing to a minimum the time interval for getting the steam generators on the line in the event of a partial or total interruption in the hydroelectric service. One of the prime factors in this is of course steam. Obviously the simplest method of taking care of this would be to maintain steam at full pressure in all boilers at all times. This, however, would not be the most economical. It remains therefore to devise some means for getting the generation of this steam under way in the shortest possible time when occasion demands.

This point seems to have been well provided for in the Bush street plant (San Francisco, Cal.) of the Great Western Power Company in the installation of an automatic oil stoking system that has proved itself to be reliable and exceedingly flexible during a period of a year's test conducted by this same company in one of its other plants.

The Bush street plant in addition to being a stand-by plant is also a low pressure central heating station, all steam to the heating system passing first through the generator turbines. The current generated, when not actually helping out in an emergency, is used for voltage regulation.

The boiler plant consists of six Stirling boilers having a total of 14 burners, two boilers being 275 h.p. each, and four boilers 350 h.p. each. The generating equipment consists of two 2500 kw. turbo-generators.

The principle of operation of the automatic oil stoking system installed is the control of the fires in a series of three steps, the apparatus embodying all the functions necessary to control the three elements of combustion in each step. These steps are desig-

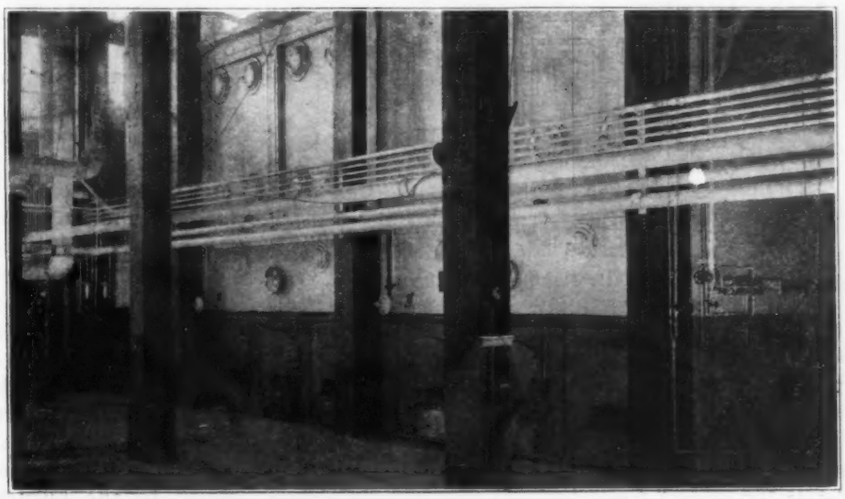


Fig. 1. The Interior of the New Power Plant, showing the Regulating Apparatus in Operation

nated pilot, intermediate and maximum fires. The pilot fire is manually controlled and set to take care of boiler radiation. The intermediate fire is automatically controlled and is set to take care of the

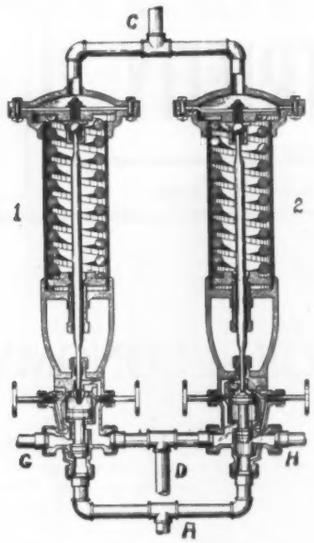


Fig. 2. The Master Controller

average load while the maximum fire, also automatically controlled, is set to take care of the maximum load of the plant.

The system is comprised of one master controller, 14 regulators, one for each burner, six interlocking damper devices, one for each boiler, and rods, levers, bell cranks, bearings and shafting as required for the operation of the ash pit and stack dampers.

The piping connecting these various devices and the oil and steam supply pipes to the burners are all overhead and are shown clearly in Fig. 1 running along the columns in front of the boilers. These pipes are named as follows: the main oil supply pipe connects the oil pump to the master controller reg-

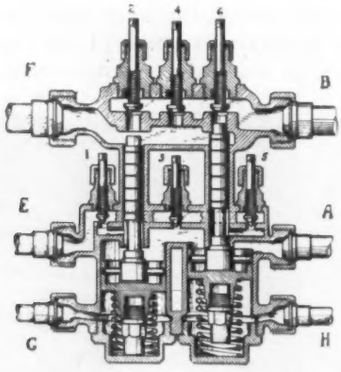


Fig 3. The Automatic Regulator at the Burner

ulators and interlocking damper devices, this pipe is lettered A in Figs. 2 and 3, the atomizing steam supply pipe connects the steam main to the regulators, this pipe is lettered B in Fig. 3; the control steam pipe, connects the boilers to the master controller lettered C in Fig. 2; the oil return pipe connects the master controller and interlocking damper devices to the pump overflow pipe lettered D in Fig. 2; the burner oil pipe connects the regulators to the burners lettered E in Fig. 3; the burner steam pipe connects the regulators to the burners, lettered F in Fig. 3; the medium fire control pipe connects the master controller to the interlocking damper devices and regulators lettered G in Figs. 2 and 3; the maximum fire control pipe connects the master controller to interlocking damper devices and regulators lettered H in Figs. 2 and 3.

In Fig. 4, may be seen the stoking system applied to a boiler. This view does not show an actual application of the apparatus to the power plant in question but is for illustrative purposes to show in one plan view the apparatus making up the stoking system and the location of the same in the piping just named.

Fig. 5 is an actual view of the interlocking damper device as applied on this installation and can be seen in place on the side of one of the boilers in Fig. 1.

The master controller consists of two portions called the intermediate and maximum fire portions. The interlocking damper devices are similarly divided while the regulators have in addition to these two parts a third called the pilot portion. As would be implied the intermediate portion (No. 1, Fig. 2) of the master controller governs the intermediate portion of the interlocking damper devices and the regulators. The maximum portion of the master controller governs the maximum portions of these devices.

The interlocking damper device interposed in the piping between the master controller and the regulators, interlocks the damper and regulator movements so as to insure that the damper openings are increased before the fires increase and that the fires decrease before the damper openings are decreased.

The adjustments of the apparatus are simple which consist in adjusting the various devices so as to give the desired fires in the several stages.

The master controller adjustment consists in setting the spring tension of the intermediate portion so that it will function at the maximum pressure carried on the boiler and the spring tension of the maximum portion so that it will function three to four pounds below this pressure.

The regulator adjustments consist in adjusting the size of the orifices through which flow the oil and steam in the pilot intermediate and maximum stages of the fire to the burner, the oil orifice being regulated by valves 1, 3 and 5, the steam orifices by valves 2, 4 and 6 in Fig. 3.

The interlocking damper device adjustments consist in placing the piston stops on the sprocket chain, Fig. 5, so as to limit the travel of both the intermediate and maximum pistons of this device to a distance that will give the proper damper movement according to the intensity of the 3 stages of the fires.

The equipment as installed in the Bush street plant is set to furnish steam at 200 lb. perssure. No. 1 portion of the master controller is therefore set to operate at 200 lb., the No. 2 portion at 197. In describing the operation of this equipment in the following it will be assumed that the regulators have been adjusted to admit the desired amount of oil and steam to the burners and the interlocking damper devices have been set to give the proper damper openings for these fires.

In each instance fuel oil is used as the power medium to operate the regulators and the interlocking damper devices as directed by the master controller and is always present in suitable chambers in all of these devices. Boiler steam pressure acting on the diaphragms in the chambers, at the top of the two portions of the master controller, in opposition to the springs underneath these diaphragms controls the flow of this oil in one direction or the other according as to whether the spring or steam pressure predominates. If the steam pressure predominates it is because this pressure has reached a point predetermined to be the limit with regard to the spring in question and oil pressure in that portion of the master controller is directed so as to decrease the intensity of the fires under the boilers retarding to that extent the increase in steam pressure. In case this was the maximum fire which was decreased the intermediate fire would still be burning, as the setting of the spring in the intermediate fire portion of the master controller is set for a steam pressure 3 pounds higher than that in the maximum fire portion. If this fire is sufficient to raise the steam pressure 3 pounds higher, the steam pressure acting on this diaphragm will be sufficient to overcome the spring tension beneath and this portion of the master controller will function so as to reduce all the fires to the pilot stage.

The pilot fires being sufficient only to take care of boiler radiation, the steam pressure will go no higher. If, however, an increased load causes a slight drop in steam pressure the spring in the intermediate portion of the master controller again predominates and this portion of the master controller functions so as to bring the fire back to the second or intermediate step. A further drain on the steam pressure will eventually cause the maximum fire to come on.

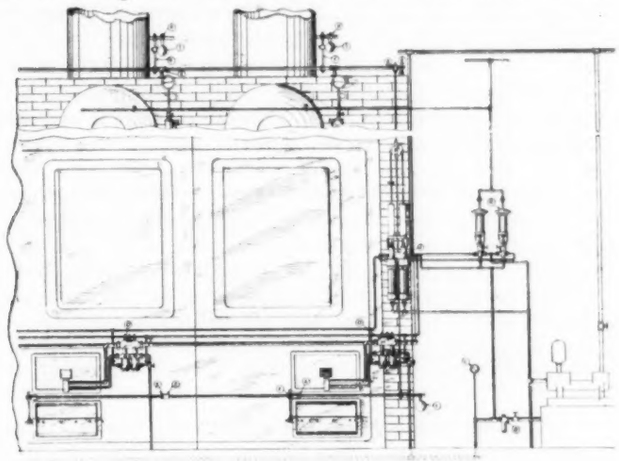


Fig. 4. Diagramatic View, showing Manner of Control for the Oil, the Ashpit and the Damper

A. Master Controller
B. Double Oil Strainer
C. Oil Gauge
D. Regulator
E. Single Bearings
F. Damper Arms
G. Clevices
H. Damper Hubs
I. Damper Weights
J. Interlocking Damper
K. Special Brackets

Both the ash pit and stack dampers are opened by weights acting through suitable levers and not by oil pressure. This is a safety feature that will result in dampers opening in the event of any unsual action.

The master controller is equipped with manually operated valves which provide instantaneous hand very readily to a number of combinations of control control of the entire plant. The system lends itself through the installation of valves and by-passes in the piping. As an example, should the conditions be such that three boilers would handle the normal load of the plant, three boilers can be cut in to work automatically between the pilot and medium fires, the others remaining on the pilot fires. Should an unexpected load, however, come on the maximum fires will automatically cut in on these boilers and both the intermediate and maximum fires will automatically cut in on the other boilers. This condition being brought about simply by operating certain globe valves in the piping. This illustration simply shows the flexibility of the system as it is actually installed. As to the efficiency of the plant, this follows naturally due to the fuel oil atomizing steam and air being controlled in a correct ratio in all stages of the fire. The maintenance of uniform steam pressure under extreme variations in load, the elimination of excess air and of the safety valve popping. In addition to economy there is another point of great importance. As this plant is located in the central part of town the elimination of smoke is compulsory, a condition that is realized through the use of the automatic stoker.

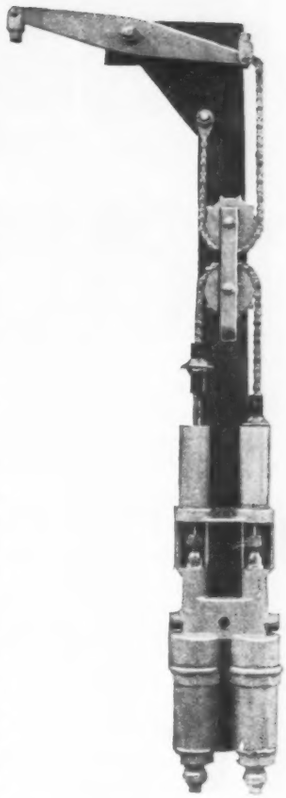


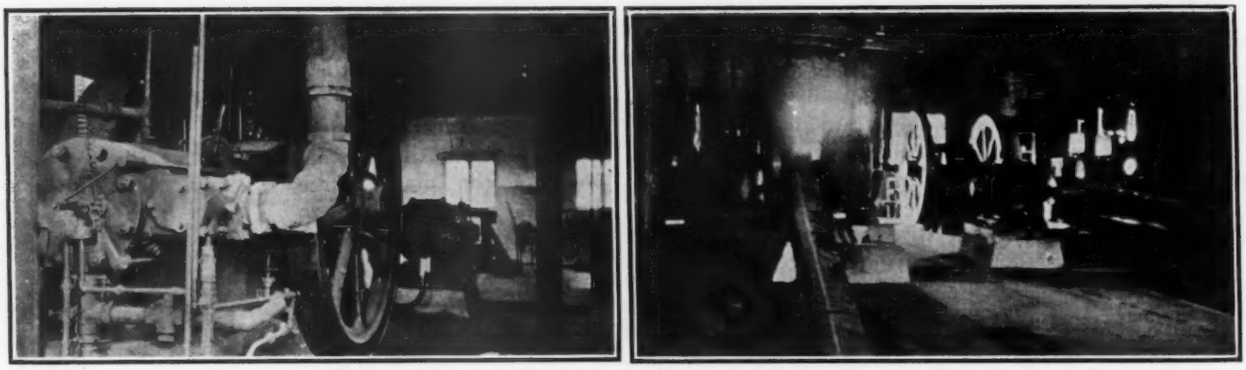
Fig. 5. The Regulator for the Damper Control

The installation has been made under the supervision of H. S. Markey, steam power plant engineer for the Great Western Power Company. The apparatus for regulating the fuel oil control is manufactured by the Westinghouse Pacific Coast Air Brake Company for the Associated Engineering & Supply Company of San Francisco, who act as distributors.

ELECTRIC ANNOUNCER USED AT DUTCH AUCTIONS

At the regular trade auctions held in the Netherlands instead of having an auctioneer call for bids there is a large dial provided with an index hand. The face of the dial is marked with prices, increasing in clockwise fashion. The hand is set at a price above that at which the goods offered will probably bring, then is slowly moved to lower and lower figures until some trader indicates his willingness to buy.

Electric push buttons are connected with the dial, which the traders press when a price satisfactory to them is shown by the dial. As the trader presses his button his number appears on the face of the dial and the lot of goods is sold to him at the price indicated by the index hand. There is no noise or confusion and the auctions are finished in a remarkably short space of time.



A STRIKING SCENE ON THE DESERT

Here is a scene typical of the advance of the hydro-electric utilization of energy in Southern California. In the first view, the gas engine for operating a pumping plant for irrigation is shown, while in the second view the small, compact electric motor service is exhibited replacing its giant competitor in the rear. Silent witnesses, such as these, encountered in ever-increasing numbers throughout the West, bear forceful testimony to the stately upward trend of the method electrical.

ELECTRIC PUMPING REPLACEMENTS OF GAS ENGINES

BY ROSS B. MATEER

(The gas-operated pumping plant as compared with the electrical unit is fast passing from usefulness in the highly developed hydroelectric districts of the West. Definite cost and operating data have long been lacking for comparative purposes. Here is an article by the commercial agent of the Southern Sierras Power Company which presents interesting and useful information on this question, as the illustrations are taken from recent replacements that have taken place in that territory.—The Editor.)

Intelligence, an asset to agricultural success was apparently seldom displayed in the early stages of agricultural development in Southern California, either in the cultivation of the soil or in the choice of a pumping plant.

It is at this time the value of an accurate, up-to-date card index is fully realized. Character of equipment, operating conditions and unit hour costs are readily obtained and a proposition based, not only on convenience but on plant efficiency and minimum operating expense is submitted to the prospective customer for his prompt acceptance. The electrification of the plant is discussed in clear, concise terms easily understood by a layman. Guarantees as to plant efficiency are conservative and backed up by the manufacturer. A reasonable time is allowed for the tearing out of the used apparatus and the installation of the "money saving" efficient equipment and the extension to the distribution system. Tests are conducted in the presence of the consumer, representatives of the machinery house and the central station. Satisfaction is apparent. An acceptance of the equipment is secured and all parties to the electrification have now not only a pleased customer but judiciously invested in good sensible and profitable advertising. Several of the many changes in plant equipment that have been effected to the welfare of consumer and utility are here cited and may prove of interest.

As the constant dripping of water will wear away a stone so will the activity of the conscientious utility salesman overcome the prejudice to electric service and educate the rancher to the many applications of electricity—its reliability, convenience and economy, as aptly illustrated by the experience of a local Mutual Water Company, which several years ago purchased and installed two sixty (60) horsepower engines to drive an eight (8) inch vertical and an eight (8) inch horizontal Byron Jackson pump for the irrigation of some six hundred (600) acres of citrus fruit land, and which only within the past year were displaced with electric service.

Comparison of Operating Charges

	Engine Operated 1915	Engine and Motor Operated 1916
Fixed Charges:		
Depreciation	$ 655.79	$ 500.00
Insurance (supervision 780)	69.14	78.12
Expense (office 120)	900.00	900.00
Repairs (engine)	619.78	700.12
Fuel	3,084.20	3,000.00
Total expense season	5,328.91	5,178.24
Inches water pumped	27,024.	26,205
Unit cost per inch	19.72c	19.08c

From the above it is evident that but for the item of $700.12 repairs to engines—the early part of 1916, the unit cost per inch of water pumped for that season had not exceeded 17.07c—conclusive evidence, perhaps that gas oil as a fuel is rapidly giving place to fuel by wire.

Typical Instances of Gas Engine Replacements

	Before	No. 1 After	Before	No. 2 After	Before	No. 3 After
Motive power	40 h.p. engine	35 h.p. Westinghouse CCL motor	75 h.p. CW motor	25 h.p. GE motor	60 h.p. engine	2 West. CCI motors 1 GE 16 h.p.
Pump	Air compressor	14 in. Layne Bowler	Air compressor	12 in. Krogh tur	3-14 in. Layne Bowler	3-14 in. pumps
Static head	26 feet	26 feet	26 feet	26 feet	14 feet	14 feet
Total Lift-Feet	50 feet	70 feet	68 feet	65 feet	59 feet	59 feet
Water pumped (in).	88 inches	122 inches	65 inches	72 inches	117 inches	117 inches
H.P. input		37.95	88	28.9		36
Plant efficiency		50%	11%	36.4%		43.2%
Acreage irrigated		50		200		225

NOTES ON PUBLIC UTILITY RATES

BY C. E. GRUNSKY

(Vital to the public utility corporations is the method utilized in the regulation of rates. Here is an excellent contribution of papers on this subject by one of our best known engineers. In his final analysis the author adopts the Unlimited Life Method of procedure in order to eliminate accrued depreciation. This series of papers which will appear in several issues of the Journal of Electricity, coming as they do from one of our highest authorities, should bring out wide discussion from valuation engineers the country over.—The Editor.)

The writer has recently been asked to define his views on the rate regulation of public utilities with special reference to the earnings which should be allowed to the public utility corporation. In doing so he will, for convenience, refer to and quote in a limited measure from some of his publications on the subject of valuation for rate-fixing purposes and related matters.

For 25 years he has had to give more or less attention to rate regulation and his views on some of the more important features to be considered were definitely crystallized when as city engineer of San Francisco, 1900 to 1904, he made appraisals of the properties of the Spring Valley Water Company. He was from the outset so firmly convinced that accrued depreciation is not an element for consideration when rates are to be fixed that he has at all times adhered to this principle and in 1912 he contributed to the American Society of Civil Engineers[1] a paper on "The Appraisal of Public Service Properties as a Basis for the Regulation of Rates," to demonstrate its soundness. He found it desirable, for the benefit of the profession, to do this, because the rate regulating authorities were generally accepting without protest the view, laid down by the courts, that "value" must be the basis of the calculation when the sufficiency of a rate is in question. Concerning the above paper of 1912,—the theory laid down in which has gone unchallenged,—Mr. J. W. Alvord says[2]:

"The question of deducting depreciation from cost new, however, is fundamental to a proper value, and, as a matter of fact, for the past 15 years, engineers and attorneys have been arguing for its deduction, and courts have been approving the practice of subtracting the depreciation from reproduction cost new in every case brought before them, without a single exception which the writer can recall. Engineering appraisal boards, so far as the writer is aware, have pursued the same practices. In water-works appraisal, the question was discussed and settled more than 15 years ago, and has never been seriously controverted since, until Mr. Grunsky's paper * * * appeared in 1912, before this Society."

It is self evident that the service rendered by, or the output of any public utility does not deterioate as the result of aging of the plant. If there is any change, the advantage should be with the long established plant which should render a more dependable and better service than a new plant. The value to the consumer of the service or of the output is in no way affected by the accruing depreciation. It is assumed of course that a well maintained plant is under consideration which shows no deferred maintenance.

The establishment of rates, therefore, should be independent of accrued depreciation. The rates found to be proper for a new plant should be equally appropriate for a plant which has been long in service. It follows that some other procedure is desirable than the one which has apparently been laid down by the courts.

Furthermore, it is illogical to require that value in any form be made the starting point when rates or reasonable earnings are to be determined because value is a result of the earnings and can not be made a premise. The courts make inquiry relating to value because they are concerned in determining whether or not the earnings are adequate to protect the value. The rate-fixing authorities, on the other hand, are free to use any method that to them seems proper in determining the required earnings of any public utility. They need not apply the value test. They should, moreover, adopt the simplest and most direct method of procedure. This the writer has repeatedly pointed out, but finds it difficult to make plain to the old line economists and valuation experts, that as a starting point, despite the decisions of the courts, a rate-base can be used which is not value. Even Mr. Alvord assumes that the writer's appraisal of a rate-base undiminished by depreciation represents value. A clear distinction should be made between the writer's "natural rate-base" determined from legitimate investment, for example, and the "fair value" or "present value" which is so commonly used as the starting point. Although so-called "fair value" has been very generally used as a rating base, this does not mean that rate-base and value should be regarded as synonymous. The rate-base may be quite as distinct from value as original cost is distinct from value.

To make this clear it is necessary to keep in mind that the rate-base is any sum to which a rate of interest is applied in determining the interest increment which should be covered by the earnings.

For example in the case of a steamboat, whose owner may have made no other investment of capital than in the steamboat, the service rendered to those who ship freight on the boat or who travel on the same is worth no more nor less if rendered by a new boat, than if it were rendered by a boat which has already been in service one-half of its probable life term.

The natural rate-base in this case is the amount invested in a new steamboat or, expressed in the usual way, the legitimate investment, undiminished by depreciation. On this rate-base the owner will be entitled to interest at a fair rate covering at least the amount which a responsible owner would have to pay for borrowed money and he will also be entitled to such renewal or replacement increments as will, if held inviolable for this purpose, replace the steamer with a new one when it ceases to be useful. But if the owner were not allowed to earn more than these interest and replacement increments in addition to cost of operation, he would not be in the business. He is entitled also to a profit which while not exorbitant

[1]Transactions Am. Soc. C. E. Vol. LXXV, p. 770.
[2]Transactions Am. Soc. C. E. Vol LXXIX, p. 232.

should yet be such in amount that this and similar enterprises will be encouraged and not discouraged.

The earnings required to meet interest and replacement apart from profit and operating expenses, would be estimated as below shown, if the interest rate to be allowed is 7 per cent and the steamboat which, new, had an expectancy of 20 years is now estimated to serve for 10 years longer:

For each $100 of original investment in the steamboat:

Interest on the rate-base 7 per cent on $100	$7.00
Replacement requirement, computed from probable life, 7 per cent	2.44
Total	$9.44

To the allowances thus computed on the entire investment there are to be added the ordinary operating expenses and also profit.

If the practice of deducting accrued depreciation from the value of physical properties be followed the computation would be as follows (again without inclusion of the operating expenses and the profit allowance):

Original investment	$100.00	
Accrued depreciation when the remaining life of the steamboat is 10 years, interest 7 per cent.	33.70	
Rate-base (so-called present value	$ 66.30	
Interest on the rate-base (present value of each $100 of original investment) 7 per cent on $66.30		$ 4.64
Replacement requirement, being the amount to be earned annually to retire the so-called present value in the remaining years of the steamboat's life, ($66.30 in ten years, 7 per cent interest)		4.80
Total		$ 9.44

In the one method of procedure a rate-base is used which may depart widely from the value of the steamboat, in the other method the depreciated value of the steamboat is introduced and this is made the rate-base.

In practice, however, to care for the profit element it has become customary to add to the present value of physical properties the value of certain intangible elements, so that in the great majority of utilities, made up of many items, the present value as used may be raised to or even beyond the natural rate-base determined from legitimate original investment undiminished by depreciation.

The aggregate value thus approximated may be a more or less arbitrary amount on which the rate of return is to be interest plus profit, or it may be the actual value which it is planned should result from a capitalization of net earnings at the interest rate at which money is obtainable for the type of utility under consideration, due regard being had to necessary discounts and commissions. If this interest rate is 7 per cent there would in the first case, a rate of return be allowed of perhaps 8 per cent or 9 per cent, of which 1 per cent or 2 per cent, as the case may be, would represent a profit in addition to the interest on that part of the intangible values known as "going value." In the second case the "going value" would be represented by the owners capitalized profit and the allowed rate of return would be not less than 7 per cent though possibly no more. Conversely, in this case, the interest on the intangible element "going value" would be the profit allowance.

The earnings of every public utility should be adequate

(a) To yield a proper interest return on the capital which has been legitimately invested in the enterprise;

(b) To renew essential items of the property when for any reason the items which have been in use must be abandoned;

(c) To meet operating expenses, including taxes, overhead, and all repair and maintenance requirements;

(d) To yield a profit, as compensation to the owner for management and hazards, and as a share in general prosperity;

(e) In exceptional cases to retire the invested capital in whole or in part when the life of the utility is limited;

(f) To amortize early losses or other legitimate sacrifices made by the owner and not proper for inclusion in the rate-base.

The legitimate original investment is not measured by original cost. This cost is to be taken into account, but, according to circumstances, remains subject to correction. The term investment as here used is understood to include actual cost of franchises and water-rights and strategic values of the same but not the intangible element of going value. The latter, as above stated, is the result of the profits of the business. Under certain circumstances the cost of reproduction, including an allowance for the cost of developing the business, will be the best guide in determining the legitimate investment, therefore, the natural rate-base.

The writer is not in accord with those who accept the principle laid down in the Knoxville Waterworks case by the Supreme Court of the United States,[3] which says:

"A water plant, with all its additions, begins to depreciate in value from the moment of its use. Before coming to the question of profit at all the company is entitled to earn a sufficient sum annually to provide not only for current repairs, but for making good the depreciation and replacing the parts of the property when they come to the end of their life. The company is not bound to see its property gradually waste, without making provision out of earnings for its replacement. It is entitled to see that from earnings the value of the property invested is kept unimpaired, so that, at the end of any given term of years the original investment remains as it was at the beginning. It is not only the right of the company to make such a provision, but it is its duty to its bond and stock holders, and, in the case of a public service corporation, at least, its plain duty to the public. If a different course were pursued, the only method of providing for replacement of property which has ceased to be useful would be the investment of new capital and the issue of new bonds or stocks. This course would lead to a constantly increasing variance between present value and bond and stock capitalization—a tendency which would inevitably lead to disaster either to the stockholders or to the public, or both. If, however, a company fails to perform this plain duty and to exact sufficient returns to keep the investment unimpaired, whether this is the result of unwarranted dividends upon over issues of securities, or of omission to exact proper prices for the output, the fault is its own. When, therefore, a public regulation of its prices comes under question, the true value of the property then employed for the purpose of earning a return cannot be enhanced by a consideration of the errors of management which have been committed in the past."

According to the view here expressed by the court every public utility should at once upon the beginning of operation earn enough, not alone to recover interest on its investment, but also to retire the va-

[3] 212 U. S. Reports 1; 29 Sup. Ct. Rep. 148.

rious articles in use, each within its term of usefulness. This is manifestly impossible because in the great majority of cases the rate-payers will be few at the beginning of operation and it would be impracticable to exact from them rates that would produce earnings determined by such a requirement. There will be lean years, years during which additional sacrifice will be demanded from the owner. Such sacrifice he must make to establish his business on a paying basis. Consideration must be given to this situation and, in determining the legitimate investment, it is proper to include therein a fair amount for the cost of developing business.

To ignore past history of the utility and to assume that if the owner has not exacted an adequate return it is his own fault, appears to the writer unfair.

In connection with the decision of the U. S. Supreme Court in the Knoxville Water Co. case the writer makes the following comment in his book on "Valuation,"[4] p. 135:

"Past history cannot be ignored if rates are to be so fixed as to be fair alike to the owner and to the rate-payer. In other words, not all shortage of earnings in the past is to be ascribed to errors of management. It is difficult to reconcile the language of the court with this principle even as it is difficult to understand why so many of the courts have held that value which results from earnings must be made the starting point when rates are to be fixed."

Sometimes, of course, the situation is presented of past earnings that were beyond all reason. The principle of "all the traffic will bear" may have been misapplied by the owner and it may be that not only what should have gone into a replacement fund, but more was actually collected from the rate-payers and that this excess as well as what should be in a replacement fund, was distributed as dividends, thereby leaving the property in an impaired condition. It is not to be understood from this statement, however, that profits, that is, earnings in excess of an allowable interest return, are in all cases to be construed as having been available for the retirement of capital or as a replacement fund. Even when there is some profit the utility might still fall short of fulfilling expectations, because both the original owner, and his successors, were and are entitled to more than a bare interest return on the sacrifice which they have made in establishing and maintaining the utility.

In the case of the complex long established corporation-owned utility, which is about to be brought under review for the purpose of having its rates regulated, the presumption should be that fair or even large profits in the past were legitimate and that having been absorbed in the dividend distributions to former stockholders, it would be unwise, as well as unfair to the present stockholders, to make the assumption that a part of these past earnings, usually taken as equal to the accrued depreciation, should all at once be deducted from original investment when setting a limit to the value which the earnings will be allowed to create. The unfairness or injustice of such a procedure has been generally recognized with the result that the allowance in the rate-base for intangible elements, particularly for "going value" is contended for by most valuation experts and is generally allowed, although none but arbitrary methods of determining the amount thereof have as yet been suggested.

Ordinarily, therefore a procedure should be adopted based on the assumption that a utility, of the complex permanent character, has not retired any capital. Its earnings have been used to make repairs and replacements of abandoned property, keeping the utility at 100% efficiency, also, to pay interest and profit to the owners. The utility should be assumed to have been conducted exactly as would be expected if it had perpetual life. Some such assumption must be made as an aid in determining the treatment to which the utility is entitled when its rates are fixed for the future. If depreciated value of physical elements is made the starting point this could only be predicated on the assumption that to the extent of the accrued depreciation, capital has been retired out of earnings. But such an assumption is just, only in cases where the fact is obvious. Otherwise the proceeding should be to introduce into the calculation, a rate-base representing legitimate original investment, as already defined, undiminished by depreciation, and to allow in the earnings such a replacement increment as will make adequate provision for the renewal or replacement of each item of property as the same becomes useless and is abandoned.

But when a rate-base is thus determined and an interest return is applied to the same which will properly compensate the owner for the use of his money (due allowance being made for discounts and commissions) some provision must be made to give him, in addition thereto, compensation for management, and for hazards, and also to give him a share in the general prosperity of the community, because this prosperity must in part, be ascribed to the installation and operation of the utility. This reward, as already intimated, usuaally, though awkwardly, makes its appearance in the allowance for "going value" and in the appreciation of real estate and other properties where value increases with age, and also in a rate of return so fixed that it will exceed in some measure a bare interest return. By this addition to the interest rate the attempt is made to bring profit into some relation to the value of the utility. This does not work well because one utility may be of a type requiring a large investment to secure a given amount of revenue, while another may secure the same revenue on a trifling investment. There is, in other words, something else to be brought into the calculation besides a rate-base. The writer in "Valuation, Depreciation and the Rate-Base," p. 160 says:

"While it is important to establish a rate-base whenever rates are to be fixed, there may be cases in which other circumstances are of equal moment with the rate-base as a guide to the allowable earnings. It may happen that the public service requires only a small investment of capital compared with the volume of the business that is transacted, and it may then be more desirable and equitable to bring the compensation of the owner into some relation to the volume of business transacted rather than to the capital which is invested in the business.

"The case may readily be conceived of a concern such as an express company which rents its office facilities and operates under contract with railroad and steamship companies and which, outside of its trucks and other vehicles for the local distribution of the parcels entrusted to its care,

[4] "Valuation, Depreciation and the Rate-Base."

has made no investment of any moment. It would be vain in such a case to attempt a regulation of rates based solely upon a fair return upon the invested capital. The whole field must be brought into view. The volume of business transacted, and the value that would be created if earnings are allowed which exceed, in some definite fashion, the cost of conducting the business, should receive due consideration. If earnings are thus allowed which exceed the cost of operation by 10 to 15 per cent, this would not seem unreasonable unless the resulting rates are, in fact, more than the traffic can or should bear."

It need only be added that such a profit allowance as here suggested might well be graduated according to the gross annual income, making the allowance larger, perhaps 15 per cent for the smaller concern and dropping materially below 10 per cent when earnings of $10,000,000 to $100,000,000 per annum and more are under consideration.

There will, however, be special cases when even such profit allowances as here suggested will be, at least temporarily, inadequate. Let it be supposed for example that the owner of the utility has made an invention or can secure the right to use an invention, by the introduction of which he can materially reduce the cost of operation, but that the introduction of the invention involves the abandonment of property which would, except for the innovation, have remained long in service. Under any hard and fast rule that no property value shall be included in the rate-base except it be in use, there would be a sacrifice by the owner represented by the former value of the discarded property. Furthermore, cost of operation being taken into account and this cost being reduced, there would be good ground for a corresponding reduction of rates. If such a reduction be made to the full extent of the reduction in operating expenses, the entire benefit of the invention would go to the rate-payer and the owner might find himself penalized to the extent of the value of the abandoned property. The proper proceeding in such a case is to allow to the owner the benefit resulting from the reduction of operating cost, for a certain time, long enough at least, to let the benefit amortize or retire the investment in so much of the property as is rendered useless, the owner finds it to his advantage to lower his prices for the purpose of increasing his business and thereby augmenting his net earnings, and thereafter, to divide the benefit between the owner and the rate-payer on a mutually advantageous basis, which will be done by introducing a larger profit allowance into the calculation than would be there under ordinary circumstance, and yet not so large as to deprive the rate-payer of some share in the benefit which has resulted from the use of the invention.

There is yet another question that arises whenever the amount of allowable earnings is to be determined for a public utility. This relates to the allowance which should be made for replacement or renewal requirements, or, as some valuation experts would say, for "current depreciation." If the property is all new and if conditions are such that any earnings determined to be reasonable and proper will actually materialize in the income from the beginning of operation, then it will be proper to proceed according to sinking fund methods using the same rate of interest as is applied to the rate-base. The replacement increments must then be placed in a fund, or will at least appear on the books to be in a fund, and the earnings of this fund must be held inviolable for use in supplementing the annual replacement increments. The fund's earnings, plus these increments, if assumptions as to probable life of the items of the plant have been correct, will be just sufficient to make renewals as these may be required.

As an alternative to this method of procedure the practice may be followed,—a new plant being again under consideration—of allowing the actual replacement requirements from year to year,—nothing the first year, a small amount the second year and increasing amounts thereafter until a time is reached when the replacement requirements will be approximately those estimated by the straight line method. This method has the advantage of simplicity. It is the method adopted on public works, such as streets sewers, public buildings, harbors and generally all public non-revenue producing properties. It is the common sense method.

Under neither of these methods, if properly applied, and if the replacement fund is actually created in proper amount out of earnings, will there have been any retirement of capital. The rate-base in each case will be original investment undiminished by accrued depreciation.

When the utility to be brought under regulation is no longer new; when it represents a plant which has seen long service, but which is at full efficiency when gauged by its own standard and falls into that class for which it should be assumed that past earnings have not retired any of the investment, the first inquiry will be as to whether or not there has been established out of earnings any replacements fund. If there be none, then the actual current replacement requirement will be the proper allowance. This will have to be estimated perhaps by the straight line method, corrected by practical experience. If the estimate be at fault no harm will be done as there will be a separate accounting for the money which goes into the fund and if the same is either depleted or grows too fast, suitable correction can readily be made in the future replacement allowances. When there is a fund, the earnings of which are retained therein, then the fund earnings will reduce the replaceement increment which is to be collected from the rate-payer.

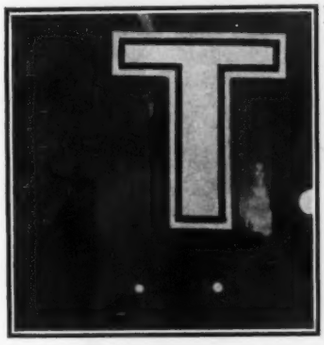
It will be seen from the foregoing that the vast amount of work which has been done in recent years to ascertain accrued depreciation as an element for consideration in regulating the rates of railroads and other public utilities is wasted energy. The requirement apparently laid down by the courts that value must be made a starting point has led experts and valuation commissions to seek new meanings in the world value. The writer hopes that some day the supreme court will so interpret or modify its Knoxville decision that the public service commission will feel free to cut loose from value when fixing upon a rate-base. He has faith in the valuation experts and economists but believes that they should press with greater vigor the demand for a simplified procedure. It is their duty to enlighten the courts. They should have the courage to point out any correct proceeding even though in conflict, at least apparently so, with

the decisions of the courts, because any conclusion of the court as expressed in the Knoxville decision remains binding only until the same has been modified by a later finding of the same high authority. Until this is done, however, the valuation engineer will find it advisable to comply with the requirements of the public service commissions, and to struggle with "present" and "market value" and let the commissions and the courts make the most of a bad situation. Now and then he may find a court which is bold enough to say that accrued depreciation may be ignored as in Idaho where, in the Pocatello Water Company case the Supreme Court of the state recently, said[8]:

"So far as the question of depreciation is concerned, we think deduction should be made only for actual tangible depreciation and not for theoretical depreciation, sometimes called 'accrued depreciation.' In other words, if it be demonstrated that the plant is in good operating condition and giving as good service as a new plant, then the question of depreciation may be entirely disregarded."

NIGHT VIEWS

BY C. B. MERRICK



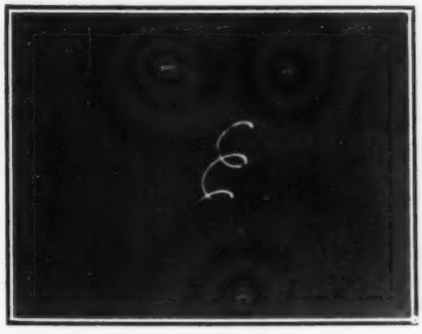
Lafayette and the Rotunda

THE Panama-Pacific International Exposition afforded an unusual opportunity for taking night views because of the type of illumination used. The indirect lighting effects approximated daylight to the extent that admirable night scenes were at the disposal of the photographer, contrasting strongly with the former possibilities when outline illumination was in vogue.

Figs. 1, 2 and 3 show the excellent lighting effects which can be obtained by time exposures, especially Fig. 2, which illustrates the spectacular side of this intensely interesting pastime. Anyone who saw the steam and fireworks display will readily recall Fig. 3. The insert shows some of the first loops made at the Exposition by Art Smith, photographed from a house top, 9000 ft. distant.

In night work it is important to avoid any moving lights which might streak the film. This can be done by closing the shutter until the light has passed.

The speed film of today has a ratio of sensitiveness of approximately 100 to 1. Consequently, two objects, one a hundred times as brilliantly illuminated as the other can be photographed together and the film will correctly record the contrast between the two. Since the variation of illumination for an average landscape is not more than 50 to 1, the photographer can underexpose the dark object, or overexpose the bright object one hundred per cent and still obtain a correct degree of contrast.



Art Smith Looping the Loop at Night, Nine Thousand Feet Away

The Exposition Fireworks, Two and One-half Minute Exposure

Average Exposures
(8 ft. candle minutes stop 16)

	Stop	Time
Indirect illumination	16	5 min.
Silhouette of outline illumination	16	6 secs.
Moonlight views (full moon)	8	1 hr.

SAFETY SUGGESTIONS FOR ELECTRIC APPLIANCES

When through using an electrical appliance, turn off the current and pull out the plug. Safe and economic.

Never leave a heated iron. If called away, first turn off current—you may be detained.

Never rest iron on cloth or wood. Use metal stand.

When using hollow-ware utensils, such as percolators, chafing dishes, see that they contain water when current is turned on. Never let them cook dry.

Don't overload a circuit by using several appliances at one time.

If the flexible cord—which should be kept dry and free from knots and twists—shows signs of wear have it repaired.

If a fuse "blows" notify your electric company. Don't experiment.

The motor on a fan, vacuum cleaner, washing machine, etc., should be occasionally oiled. If it becomes so hot that it cannot be touched with comfort, turn off current and notify your dealer or electric company.

Do not attempt to install or extend existing wiring or make repairs. Such work should be done by an experienced electrician.

AN ELECTRICAL METEOROLOGICAL STATION

The second meteorological station in the United States for the gathering of data of the upper air will shortly be erected in Hawaii unless the plans of the army and of the weather bureau go askew. By a proposal presented by the local representative of the weather bureau, A. M. Hamrick, and enthusiastically endorsed by the army authorities of this department, an electric-reel station from which will be flown the great kites which carry the instruments aloft is planned to be placed here as soon as practical.

BEARING CURRENTS IN A ROTARY CONVERTER

BY L. J. CORBETT

(Bearing currents in a rotary converter and the consequent excessive pitting and scarring caused by these currents at starting is a subject of timely interest throughout the West, where inventories are being taken to increase outputs of installed apparatus to meet the gigantic industrial strains now encountered in central station practice of the West. The author is professor of electrical engineering at the University of Idaho and a well-known investigator on electric pumping and irrigation in the Northwest. —The Editor.)

In one of the shops of the University of Idaho is a rotary converter used to supply direct current to a number of shop motors from the three-phase mains of the power company. The attention of the writer was called to it some months ago, as it sparked badly at the end of the shaft when starting, (from the a.c. end), and in addition it had become very difficult to start in this manner, too frequently tripping the automatic oil switch and thus cutting off the shop power. It was evident that the trouble was due to bearing currents and their effect upon the shaft and babbitt linings, so these features were investigated at once.

Fig. 1. Shaft, showing Excessive Pitting and Scarring Caused by Bearing Currents at Starting

As the primary field rotates about the armature when the armature is first energized, the rotating field becomes exceptionally strong at the instants when its poles coincide with the stationary poles of the frame. When it leaves this position the reluctance is increased and the magnetism lessened. Such action as this causes bearing currents that bring about the excessive pitting indicated in the illustration.

Fig. 1 is from a photograph of one end of the shaft at the position of the bearing and shows the excessive pitting and scarring caused by the bearing currents at starting. Some of this is due to the popping sparks noted at or before the armature commences to revolve; the balance to silent electrolysis after the armature has gained headway and before the field is energized.

The converter is started from the a.c. and by connecting to the three-phase line with resistance in two of the leads. After the armature has come up to synchronous speed the switch is thrown to the running position in which these resistances are cut out of the circuit, after which the field switch is closed.

Fig. 2 shows an end view and Fig. 3 a side view in outline of the converter, and the following explanation of the generation of these harmful currents is offered.

The winding upon the armature is an ordinary polyphase converter winding with taps and rings for one-phase, two-phase, three-phase and six-phase operation. It had been relegated, of late years, to use as a three-phase converter in regular service, though formerly intended as a special machine for laboratory purposes. When the starting switch is closed, connecting the armature to the three-phase line through resistances, a rotating magnetic field is induced as in the case of the induction motor, which travels around outside of the armature. Copper grids inserted in the pole faces act in the same manner as the bars on the rotor of a squirrel cage induction motor, the reaction of the magnetic fields of the primary currents and induced currents causing the armature to turn.

As the primary field rotates about the armature when the armature is first energized, the rotating field becomes exceptionally strong at the instants when its poles coincide with the stationary poles of the frame. When it leaves this position the reluctance is increased and the magnetism lessened; it is decreased again and the magnetism increased as the poles of the rotating field come into coincidence with the field poles again a half cycle ahead.

The magnetism in the frame has been reversed during this half cycle. If in Fig. 2 the field poles, when serving only as portions of the magnetic circuit for the rotating field, are as indicated at a given instant, a half cycle later they will be of the opposite polarity. The fluxes $\emptyset_1$, $\emptyset_2$, $\emptyset_3$, $\emptyset_4$ will be alternating All of them will be cut by the metal of the armature

and shaft, which may be considered as one conductor, and also by the frame and field poles, which may be considered as another conductor. If the frame and field poles were symmetrical, the fluxes would be equal and balanced, but this condition is not realized, so there will be a preponderance of magnetic flux cut by the rotating conductor first in one direction and then in the other.

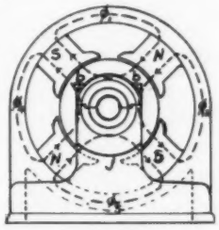


Fig. 2. Field Poles, showing Portions of Magnetic Circuit for Rotating Field

This generates an alternating e.m.f. in the shaft system which sends a current through a shaft and frame by way of the bearings as indicated in Fig. 3.

At the time of starting, the rotating field travels around the armature at 1800 r.p.m. When the converter armature has reached synchronous speed this field is stationary in space, as the poles of the rotating field coincide with the actual field poles as in

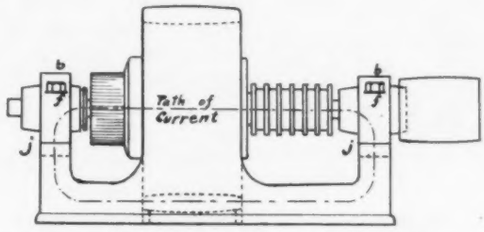


Fig. 3. Typical Currents Through Frame and Shaft

a synchronous motor. Under these conditions there will be no appreciable current flowing in the shaft.

The remedy adopted in this case was the thorough insulation of the joints in the frame directly below the bearings. A layer of empire cloth at the joint (j) and a wrapping of the bolts (b b) with the same material with fiber washers at (f f) sufficed for this purpose and there has been no further trouble from this source.

WIRELESS TELEPHONE WILL BE USED BY THE NAVY IN WAR

Wireless telephony as well as wireless telegraphy will be used by the United States Navy in its war operations. A year ago, by order of Secretary of the Navy Daniels, telephone officials of the Bell system and Navy officers planned and successfully carried out a three-day mobilization of communication forces during which war conditions were simulated. Instantaneous communication was provided over the wires of the Bell system by both telephone and telegraph from the office of the Secretary at Washington to all the naval stations in the continental United States, and wireless telephone communication was maintained between the office of the Secretary and an American battleship in the Atlantic Ocean.

Since that time engineers and scientists connected with the Bell system have been working in close cooperation with officials of the Navy Department and have developed further the use of the wireless telephone in the naval service. The plans followed in the original mobilization have proven in practical operation to be as highly satisfactory as they were at that time.

The telephone and telegraph engineers, whose organizations are all represented on the telegraph and telephone committee of the Council of National Defense, have also been working with the Army and naval officials, the National Research Council and the Naval Consulting Board on many research problems of vital importance to national defense, such as telephone communication with airplanes, new wireless methods, and apparatus for detecting the presence of submarines, and important progress has been made.

A MAMMOTH OFFICE SWITCHBOARD

When the Southern Pacific Company's new building at Steuart, Market and Spear streets is completed in November of this year, it will boast of the very latest type of eight position telephone switchboard, which is now being constructed for the company at the Western Electric factory at Hawthorne, Ill. This will be one of the largest—if not the largest—private branch switchboards on the Pacific Coast and will permit of additional sections being added from time to time as the company may require. In addition to this, the chief operator will be provided with a supervisory position from which she can supervise the service, both incoming and outgoing, from her desk, and take care of any overflow that the regular switchboard is unable to handle expeditiously.

In the new building there is to be a switchboard with a maximum of eighty lines and more modern than the one now in use, to take care of the company's exclusive service. These modern switchboards are being installed primarily to attend to the public wants.

The telephone in the new Southern Pacific building is being arranged with a view to affording the operators plenty of light and air. The telegraph office will be equipped with the latest type of telegraph apparatus, repeater tables, test panels, and will be arranged with a view to increasing the efficiency of the telegraph department.

VOLUME OF CALIFORNIA RIVERS MEASURED

Throughout the Sacramento and San Joaquin valleys water has relatively large value for irrigation, and the enormous importance of California water powers is now generally recognized.

Water-Supply Paper 391, "Surface Water Supply of the Pacific Slope Basins in California," will be useful to engineers and others interested in the utilization of the streams in that region, although it is too technical to be of value to the general reader. Copies may be obtained without charge by applying to the Director, United States Geological Survey, Washington, D. C.

"DOING-IT-ELECTRICALLY" IN THE SCHOOLS

BY HOYT CATLIN

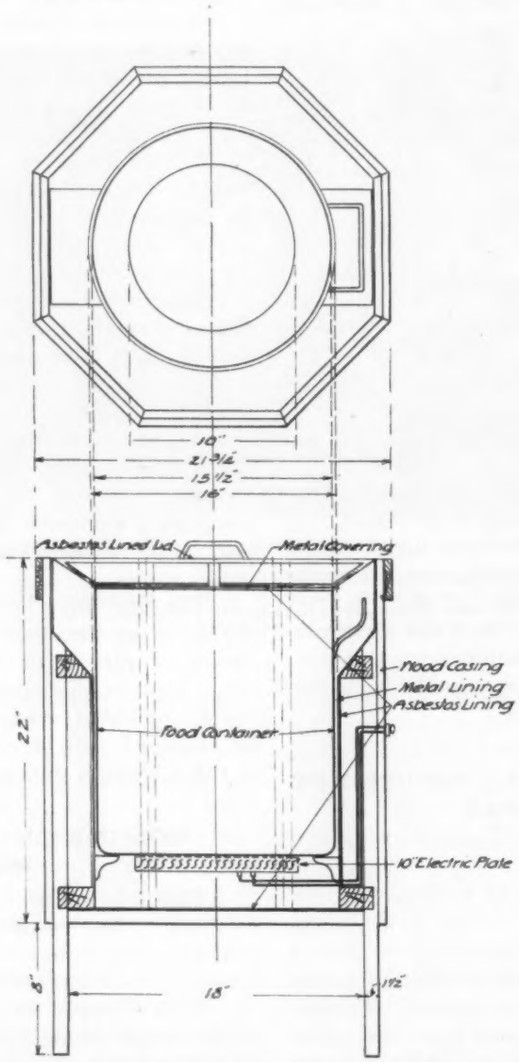
(Here is a brilliant idea that will serve to indelibly impress upon the children of the schools the wholesome uses to which electricity may be put. In this electric soup-cooker, a cheap and healthgiving beverage is provided electrically for each child at the nominal price of a cent and a half and the older children are given an opportunity to use their ingenuity in construction and operation of the device, thus clinching for all time their interest and knowledge in the fundamentals of the art. Plans and pictures are shown herewith so that central station managers and commercial agents generally can pass the idea along to the various communities served throughout the West. The idea originated with the author who is connected with the staff of the Pacific Power & Light Company, and with F. G. Weller who is principal of the Nob Hill School at North Yakima, Wash.—The Editor.)

The Nob Hill School in North Yakima equipped its domestic science department entirely with electric equipment during the past summer. After trying it for a month or so during the fall term, this department found electricity so satisfactory and the cost of operation so reasonable that the Pacific Power & Light Company was asked for information upon the subject of preparing electrically the noonday hot lunches.

We found that during the previous term the school had prepared about five gallons of hot soup or cocoa per day. This had been served to the eighty pupils at a cost of one cent per cup. Not all of the children purchased the hot soup regularly.

The attention given by the teacher of domestic science to the operation of the disagreeable oil stoves occupied so much of her time that she could not give the food the care it required. At the beginning of this past fall term the officials of the school were quite dubious as to the prospects for a satisfactory hot lunch service for the coming winter. To prepare the large quantities of liquid required upon the surface burners of any ordinary electric range would have been a slow and expensive process. We recommended that we be allowed to make for the school a special soup cooker of eight gallons capacity. After some delay, the cooker was constructed and installed.

As the accompanying pictures illustrate, this cooker was made by placing a heavy sheet metal lining inside a wooden cabinet, this lining supporting the electric heater and the seamless granite stock kettle for the soup. Three inches of air space was left between the lining and cabinet. The kettle is supported independently of the heater, by lugs riveted to the inside of the lining. The 2000-watt, three-heat Westinghouse 10 in. heater disk is supported by four light frames which hold it so that it is in light contact with the bottom of the stock pot when it is in place. A three-way switch controlling the heater disk is fastened to the outside of the cabinet and a Hubbell receptacle placed alongside it for connection to the power circuit through a flexible cord. Two inches of asbestos boardware was placed in the bottom of the lining to prevent escape of heat downward and to eliminate the danger of charring the wood of the cabinet.



DETAIL DESIGN FOR ELECTRIC COOKER

Here is a complete design for an electric soup cooker that has proved economic and effective in serving hot soup to the school children at North Yakima, Wash. Its design is so simple, its economic features so pronounced, and its possibilities of educating the young in the uses of electricity so marked, that its use is highly recommended for other districts throughout the West.

The heater disk is not connected as it is in the Westinghouse range. On full heat, the whole surface of the heater is active. On medium heat the 4 in. center is cut out. On low heat, only the middle two-ring section burns. This system is used to prevent burning of foods which would normally be over the intensely hot center. This idea has worked out perfectly in practice as no food has ever been burned in this soup cooker.

The cost of this heater complete was about twenty-five dollars.

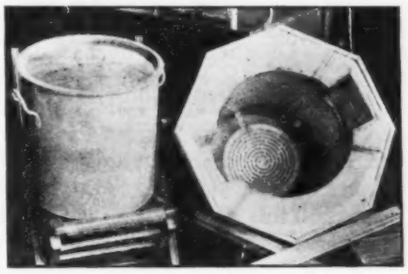
To pay for the heater in two years and to cover all costs of making the soup—materials, electricity, etc.—the cost of the service was raised to 1½ cents a cup. This permits the school to supply a very pleasing quality of soup, the expenditures for soup making materials

being almost doubled over the preceding year. The attention given the cooking of the soup is almost nothing. The children take turns in serving it and washing the dishes. Practically every pupil in the school has purchased the soup every day during the

Electric Soup Cooker Ready for Work

past season. The school board, the teaching staff and the children themselves are all enthusiastic over the system.

It is the intention of Mr. Weller, the principal, to utilize this cooker in the Mother and Daughter clubs this summer for the preparation of fruits and vegetables for canning. Inasmuch as it has cost the



Two Views of the Cooker

school but two dollars per month to operate it for the soup cooking, the ones in charge are confident that they have solved the problem of heat for canning operations. We are watching this apparatus with much interest.

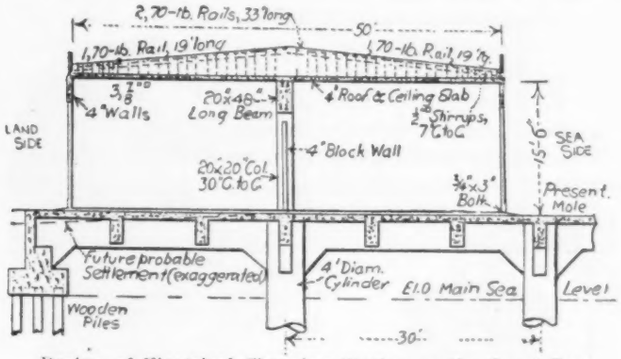
GIGANTIC ELECTRICAL EQUIPMENT FOR CANTONMENTS

Estimates of the total requirements of electrical equipment for the sixteen military cities amounts to 20,800,000 ft. of insulated wire, 260,000 ft. of lamp cord, 125,000 key sockets, and about the same number of shades, 150,000 cleat receptacles, 22,000 snap switches, 27,800 combined switches and plug cut-outs, 75,000 plug fuses, 3,000,000 pairs of unglazed porcelain tubes; about 7,000,000 1¼ to 2¼ in. wood screws, 9600 lb. of friction tape, 4000 lb. of solder, and other items on a similar scale.

THE ELECTRIC CHARGING STATION AT CRISTOBAL TERMINAL

In view of the increasing uses of electricity in the West for the operation of electric trucks, the following design of a charging station in the Canal Zone should prove interesting:

The building for the repair shop and electric charging station for the electric trucks employed at the docks at Cristobal has been completed, and pending the arrival and installation of the electrical equipment,



Design of Electrical Charging Station on the Canal Zone

placed in service temporarily as a loft and storage house.

The building is at the head of the slip between Piers 8 and 9, on the concrete paving on the mole, back of the landing wharf for small boats, and its location is responsible for a construction which is a novelty on the Isthmus. The weight of the building is carried on a row of columns extending along the longitudinal axis, and these columns are supported on the steel and concrete caissons on which rests the paving at the head of the slip. On the side next the land the paving is supported on timber piles which have settled slightly. In order to assure the charging station against settlement it was constructed with a continuous reinforced concrete beam which extends the length of the building on the center columns and from which the side walls are literally suspended by means of cantilever beams set at intervals of 10 ft. The walls are only four inches thick. The wall on the sea side is made fast to the paving by means of anchor bolts.

The building is 271 ft. 8 in. long by 51 ft. 4 in. wide and one story high.

ELECTRIFICATION OF SWISS FEDERAL RAILWAYS

The electrification of the Swiss Federal railways, which for 15 years has been strongly advocated throughout the country, but has met with serious obstacles during the war, has now emerged as a very practical economic question. In developing the plans for electrification, the government has created a special department, attached to the Direction of the Swiss Federal Railways, known as "Direkiton fur die Einfuhrung der elektrischen Zugforderung der Schweizerischen Bundesbahnen, Berne, Switzerland."

This department announces that it is prepared to consider proposals for sale and delivery of such electrical material as may be necessary for equipment in connection with this work, and that bids will be received from all countries.

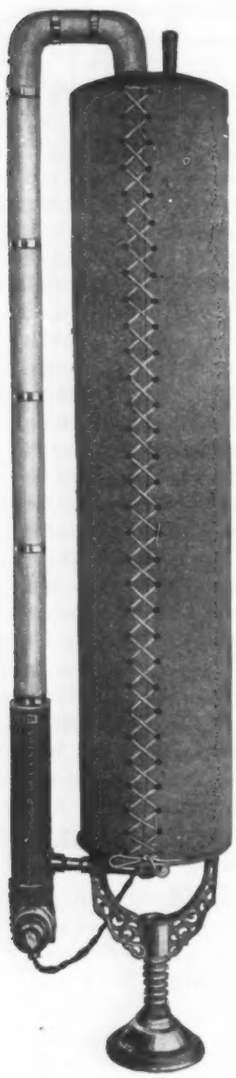
THE SELECTION OF HEAT INSULATING MATERIALS

BY JOHN CRAWFORD, JR.

(Efficient insulating materials are daily helping to solve the ever important problem of economic heating of water by electricity. Here is a treatise on this subject that will prove of immense assistance to our readers throughout the West, as it comes from a well-known authority on this particular line of discussion. The author is manager of the asbestos and magnesia department of the San Francisco branch of H. W. Johns-Manville Co. A synopsis of this paper was delivered before the Riverside Convention of the Pacific Coast Section N. E. L. A.—The Editor.)

In view of the fact that there are few items of mechanical equipment that will show such a high return on investment and which bear such a low yearly charge for maintenance and repairs as heat insulation, it is rather surprising that the engineering profession, generally, has given this subject so little serious study.

The reason for this to a large extent has been the lack of authentic and impartial data on the heat losses from bare surfaces and the saving to be effected by various types of heat insulation. Within the past few years, however, the research laboratories of our universities; the United States Bureau of Standards, and private corporations, have contributed much very valuable data on the subject of practical heat insulation.



Boiler and Piping Insulated for Electric Water Heating

With this information available, there is no longer any reason why the engineer should not give the same careful consideration in selecting the proper type and thickness of insulation to give the highest permanent return on investment in terms of fuel saved and increased operating efficiency which he uses in specifying any other mechanical equipment.

In order to appreciate why one type of insulation is preferable to another for any particular condition of service, it is necessary to have a clear conception as to what heat is and the modes by which it travels.

Heat is the phenomenon resulting from the vibration of the molecules composing matter. The extent of sensible heat in a substance—or its temperature — increases the rapidity of this molecular vibration. So far as this earth is concerned, temperature may be said to range from minus 460° F. (absolute zero), at which point the molecules in matter are without movement, to 9608° F., the temperature of the sun, where rapidity of molecular vibration is very high, though the temperature of one of the stars in the constellation of Taurus is 27,000° F. The highest available temperature we have, practically, is the electric arc which is 6500° F.

The progress of heat from a higher temperature to a lower temperature in the same solid, homogeneous body is called heat conduction. This heat transfer is effected by the gradual communication of the more rapid molecular vibrations at the hotter points—molecule by molecule—to the cooler points. When the speed of vibrations is equalized at all points, heat flow ceases.

The time required for heat to be conducted from one point to another point in the same substance—i. e. for the molecules vibrating most rapidly to communicate the speed of their vibrations to adjacent molecules—varies with each substance. At one end of the scale we have a perfect vacuum, which cannot conduct heat (since no matter is present) and at the other, silver, which is the most rapid known conductor of heat.

Of all practical substances air is the poorest conductor of heat and—as will be brought out later in this paper—this fact is taken advantage of in the manufacture of all thermal non-conducting materials.

In mobile bodies, such as liquids and gases, the ability of the body to move within itself assists in the transfer of heat by what are known as convection currents. All liquids and gases expand as their temperature rises—i.e. their weight per unit volume decreases. Hence, if we communicate heat to the lower stratas of a mobile body—air for example—a local portion of the air at the bottom expands and becomes lighter than the cooler air above and around it. The lighter air will rise and the cooler air will sink and take its place. Thus a circulation is induced which brings the warmer and cooler portions of the air in intimate contact until the temperature of the entire mass has become equalized.

Thus, it is apparent, that although air—per se—is the slowest conductor of heat, its mobility makes these convection currents possible. Hence, the coolest portions of the air will be brought in direct contact with the hottest portions of the air and the whole will attain a uniform temperature quite rapidly. The velocity of these convection currents—or the rapidity of this communication of heat from the hotter portions of the air to the cooler portions—increases very rapidly as the difference in temperature between them becomes greater.

It is generally supposed that the velocity of these convection currents varies in an increasing geometrical ratio with the difference in temperature between the hottest and coldest stratas of air.

One of the greatest functions which thermal non-conducting materials have to perform, is to reduce to a minimum the loss of heat by convection currents of

air, either through the non-conducting materials themselves or between them and the surface they are designed to insulate. Hence, in selecting non-conducting materials, one should consider carefully as to whether their nature and design is such as to give assurance that they will permanently reduce heat losses by convection to a minimum.

Thus far, we have only considered the travel of heat in homogeneous bodies, but of the greatest importance is the law governing the transfer of heat from one body to another—heat moves from a warmer body to a cooler one by what is termed radiation.

In order to explain the transfer of heat by radiation, we must accept the theory that the entire universe, including all space (even the perfect vacuum) and the interstitial spaces between the molecules in all forms of matter, is permeated by a medium of infinite tenuity—i.e. having neither weight nor volume—which is termed luminiferous ether. This ether is susceptible to the molecular vibrations in matter which cause similar vibrations to be set up in it. We may conceive these ether vibrations to carry heat in a manner analogous to the mode of travel of light by light waves.

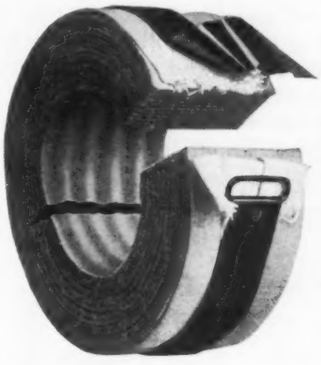
The rapidity of these ether vibrations varies as the difference of the fourth powers of the absolute temperatures of the hot body and the cooler one to which they are traveling. Just how significant this fact is may be well illustrated by the fact that if one stands in direct sunlight on a cold winter's day, he may perspire—though the temperature of the air be below zero—but if the sun is obscured by a cloud, he almost instantly feels cold. We know that the sun is 94,000,000 miles away and even light waves, traveling 186,427 miles per second, require about 8 minutes to progress from the sun to the earth. Hence, the speed which these vibrations attain, due to the enormous temperature difference between the sun and the earth, to reach the earth almost instantly, is beyond our conception.

Whereas heat lost by radiation through the walls of cold storage rooms is insignificant because of the relatively slight temperature difference between the air inside and outside, as this temperature difference increases in low pressure steam, high pressure steam, and superheated steam, so does the consideration of heat transferred by radiation become correspondingly of more importance.

Radiant heat is almost entirely absorbed by some substances, almost entirely reflected by other substances and neither reflected nor absorbed by other substances, but almost entirely transmitted. The ability of a body to reflect, absorb, or transmit radiant heat varies with its chemical composition, the diversity of its molecular arrangement, its physical structure and the nature and color of its surface. In a restricted sense, we may say that those substances which are capable of conducting heat most rapidly will radiate, or conversely, will absorb it most slowly—though there are many exceptions to this statement.

Pure silver, which is the best known conductor of heat, will, when polished, absorb radiant heat waves more slowly and likewise give it off more slowly, than any other substance. At the other extreme, we have lamp black, which is a very poor conductor of heat, but which will absorb and disperse radiant heat more rapidly than any known substance. Then we have such substances as air, glass, and rock salt, which will neither reflect nor absorb radiant heat to a great extent but which have the power of transmitting it readily to other bodies. Rock salt, for example, reflects less than 8 per cent of the radiant heat which it receives, absorbs scarcely any, and transmits practically 92 per cent of it.

In general, we may say that smooth, light colored, plane surfaces (approaching a sphere of polished silver) lose the least amount of heat by radiation and reflect the greatest amount. On the other hand, rough, dark, irregular surfaces (approaching lamp black) lose the greatest amount of heat by radiation and reflect the least.



Magnesia Protection for Piping

Now, to recapitulate:

Heat transfer within a solid, homogenous body is by conduction. The rapidity of the heat transfer varies with the nature of the body and directly as the difference in temperature between the hottest and coolest points.

Heat transfer within a mobile body is by conduction, augmented by convection currents. Its rapidity is dependent on the nature of the matter and on the velocity of the convection currents. The rapidity of these increase in some geometrical ratio to the difference in temperature between the hottest and coolest points.

Heat transfer from one body to another is by radiation—i.e. waves in the medium luminiferous ether. The velocity of these waves increases as the difference of the fourth powers of the absolute temperatures of the hottest and coolest points.

Now let us trace the flow of heat from steam in a pipe to the air surrounding it—

The molecules of the steam are vibrating with a certain rapidity commensurable with the indicated temperature. This movement sets up similar vibrations in the ether which permeates the spaces between the molecules. As ether has no boundaries, the ether waves in the steam, by the law of radiation, pass into the iron pipe. This sets up similar vibrations in the molecules of the pipe. By the law of conduction, the heat progresses from the inside to the outside of the pipe. Again, by the law of radiation, the heat is transferred by the medium, ether, to the surrounding air and by the law of convection the air near the surface of the pipe carries its heat upward and is replaced by cooler air, which movement continuously robs the pipe of heat. The speed with which heat leaves the surface of the pipe by radiation to the surrounding air will depend, of course, on whether the pipe is black or galvanized and whether smooth or rough.

THE ADVANTAGES OF TRADE ACCEPTANCES

When the contractor-dealer buys merchandise from jobbers, he will promptly check the goods upon receipt. Any claims will be adjusted at once. Unless he prefers to send a check within ten days he will sign an acceptance, that is, an agreement to pay a definite amount on a definite date. This of course entitles him to a little better terms (either cash discount or a longer time) than the man whom the jobber carries on open account.

Furthermore, the contractor-dealer who is running his business on sound lines can consistently sign and meet acceptance. He will thereby establish a good credit. The weak or careless concern will be showed up by refusal to sign acceptances, and will have to get into better shape or drop out. Of course a concern which failed to meet a signed acceptance would be blacklisted by the banks and on about the same basis as the concern which passed a bad check. In one sense, an acceptance is much the same as a check payable at a future date.

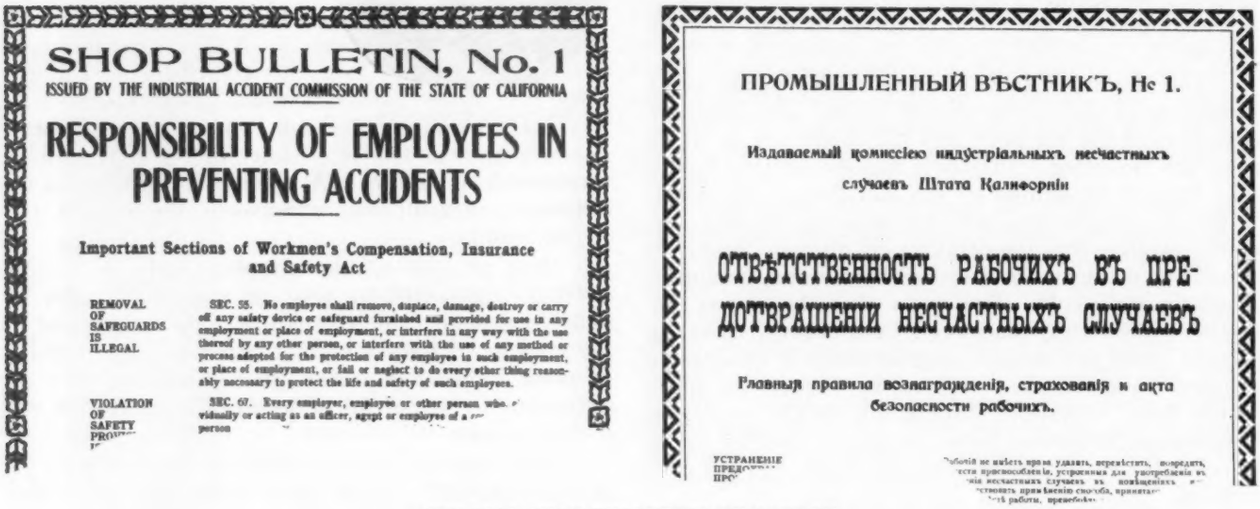
Secondly, the contractor-dealer would ask for acceptances from owners or general contractors. That is, if the owners or general contractors do not care to give a check, they acknowledge the indebtedness and agree to pay on a specified date, i.e. they sign an acceptance. This acceptance the contractor-dealer can take to his bank and discount at a favorable rate (probably at ½ of 1 per cent less than would be required on ordinary paper.) This means that the contractor-dealer will not have to carry his customers who need time, but shifts this burden where it belongs on the bank.

There are two chief advantages, then, in the adoption of trade acceptances by the contractor-dealer. First: the tendency will be toward sounder credit for the best concerns and forcing the shaky concerns either to strengthen themselves or be denied credit altogether. Second: the contractor-dealer can use his funds in developing his business instead of carrying his customers, and will also have fewer losses and fewer unfair claims.

SEASONAL DISTRIBUTION OF FOG

Engineers will be interested to know of the results of a five-year study on the seasonal distribution of fog throughout the various coasts of the United States by the United States Bureau of Lighthouses. The figures indicate the following general facts: Fog is most prevalent along the New England coast in the summer months, and on the South Atlantic coast during the winter months. On the Middle Atlantic coast fog is more evenly distributed, the minimum amounts occurring during the late summer and early autumn. On the Pacific coast of the United States proper the distribution of fog is fairly uniform in all portions from north to south, the minimum amounts being observed in the spring and the maximum in the late summer and early fall, resembling, in general, the same seasonal distribution as obtains in New England.

SAFETY NOTICES



SHOP BULLETIN, No. 1

ISSUED BY THE INDUSTRIAL ACCIDENT COMMISSION OF THE STATE OF CALIFORNIA

RESPONSIBILITY OF EMPLOYEES IN PREVENTING ACCIDENTS

Important Sections of Workmen's Compensation, Insurance and Safety Act

REMOVAL OF SAFEGUARDS IS ILLEGAL

SEC. 35. No employee shall remove, displace, damage, destroy or carry off any safety device or safeguard furnished and provided for use in any employment or place of employment, or interfere in any way with the use thereof by any other person, or interfere with the use of any method or process adopted for the protection of any employee in such employment, or place of employment, or fail or neglect to do every other thing reasonably necessary to protect the life and safety of such employees.

VIOLATION OF SAFETY PROVI...

SEC. 67. Every employer, employee or other person who ... vidually or acting as an officer, agent or employee of a ... person

ПРОМЫШЛЕННЫЙ ВѢСТНИКЪ, № 1.

Издаваемый комиссіею индустріальныхъ несчастныхъ случаевъ Штата Калифорніи

ОТВѢТСТВЕННОСТЬ РАБОЧИХЪ ВЪ ПРЕДОТВРАЩЕНІИ НЕСЧАСТНЫХЪ СЛУЧАЕВЪ

Главныя правила вознагражденія, страхованія и акта безопасности рабочихъ.

УСТРАНЕНІЕ ПРЕД... ПРО...

...бочій не имѣетъ права удалять, перемѣстить, повредить ...ства приспособленія, устраненныя для употребленія въ ...ніи несчастныхъ случаевъ въ помѣщеніяхъ и ... установить примѣненіе способа, принятаго ...ей работы, примѣнен...

TYPICAL SHOP BULLETINS ON SAFETY

Much attention is being given to safety propaganda throughout the West. The resultant good effect is already noticeable in the saving of life and property. Here is a part display of a shop bulletin covering general rules for safety which has been distributed broadcast by the California Industrial Accident Commission. The bulletin is printed on durable cloth and has been translated into many languages, the one shown on the right above being Russian. A very marked degree of co-operation between the workers of the commission, the employers and the laborers has been observed in California.

PREFERABLE WIDTH OF TIRES

Width of wagon tires recommended for loads of varying magnitudes on earth and gravel roads has been made of especial study by the United States Department of Agriculture in a recent publication. The resultant conclusions may be of interest to central station operating departments:

Width of Tire Recommended for Wagons of Different Carrying Capacities.

Type of Wagon.	Gross Weight Loaded. Pounds.	Width of Tire. Inches.
1-horse wagon	2,000	2
Light 2-horse wagon	3,500	2¼
Medium 2-horse wagon	4,500	3
Standard 2-horse wagon	6,800	4
Heavy 2-horse wagon	7,500	5

PRESENT DAY ENGINEERING PROBLEMS IN THE WEST

(Joint pole construction, automatic switch protection and the operation of standby stations for hydroelectric power are problems that have aroused unusual interest among engineers throughout the West where favorable conditions exist for development of vast quantties of hydroelectric energy and heavy demands are made for carrying irrigation loads. In the following pages these problems are discussed by a number of leaders in engineering thought along these lines and the careful weighing of the arguments that are advanced should prove very helpful in every section of the West. This discussion is taken from the stenographic report of engineering section of the Pacific Coast Section, N. E. L. A. Convention at Riverside.—The Editor.)

Chairman J. E. Woodbridge: One subject scheduled for this morning was left over due to lack of time, and that is Joint Pole Construction, on which we had a paper by the Secretary of the Los Angeles Joint Pole Committee. In San Francisco we are only starting joint pole construction, but even in starting we have learned some things, and I would like to ask Mr. J. M. Barry, formerly city electrician of San Francisco, to tell us about the organization of the committee there.

Joint Pole Construction

J. M. Barry: In San Francisco the joint pole system was started about a year ago. At that time there was considerable agitation for additional underground districts. In order to satisfy the public demand for better pole conditions, the board of public works, the city department of electrcity and the representatives of the various railway, power, telephone and telegraph companies got together for the purpose of organizing a joint pole committee.

The joint pole scheme was not new with all the companies. Some of them had been operating under such arrangements in Oakland and in some of the smaller towns, and it was simply a case of adapting already established methods to San Francisco. The companies showed an excellent spirit in getting into the proposition, and since the organization a year ago many pieces of joint construction have been satisfactorily completed. The movement has resulted already in a falling off of the demand on the part of the improvement associations and the city for additional underground districts. We have an ordinance in San Francisco which authorizes the city to require that poles and wires be removed from 2½ linear miles of streets each year. At the present prices of materials, 2½ miles of underground construction annually would be a heavy burden, and the companies have welcomed relief from any direction that it could be found. The good record of the companies represented on the Joint Pole Committee has this year obviated the necessity of an ordinance requiring additional underground construction. This, I think, is a highly creditable showing. Under certain conditions, underground districts are desirable, but in San Francisco new districts have not always been wisely chosen. For example, the last one to be declared is very largely residential, with scattered loads, and is not a good underground proposition from an economic standpoint. It is hoped that joint pole construction rather than new underground districts will be the means of improving conditions in such localities in the future.

In connection with operation under joint pole conditions I think it would be well for the companies involved in the joint construction to complete their joint construction as soon as possible after deciding upon it. Very often, construction originates from a complaint from an improvement association because of bad pole conditions in some street. The intentons of the member companies are good, but there has been a tendency on their part to let the joint construction work go over until more important work had been disposed of. The result is, that there have been one or two instances where the improvement associations have questioned the good faith of the companies and have been on the verge of starting agitation for additional underground districts. For this reason, I think it is well for all parties interested to prosecute their joint pole work as diligently as possible.

Chairman Woodbridge: I believe Mr. Lisberger has served on that committee and can tell us something about the committee organization of San Francisco.

S. J. Lisberger: Mr. Chairman—The organization of the Joint Pole Committee is not difficult. The principal object in an organzaton underaking joint pole work is to appreciate the object you are trying to accomplish and most difficult of all you will find the prejudices and feelings of loyalty on the part of the several companies about to enter the agreement. If these will be thrown aside and if you will put yourself into the shoes of the other fellow, you will have ing that one company is trying to get the best of the other wiped away most of the obstacles. There is always the feeland it will take some little time and effort to overcome that difficulty.

Mr. McDonald has outlined the work of the Joint Pole Committee and I cannot add anything to his remarks. I do want, however to voice one sentiment, which I hope will not be misunderstood. Joint pole construction is advisable where several poles are likely to be located in the same locality. It is advisable from the standpoint of public opinion and there is no doubt that it does tend to relieve the burden of placing wires underground.

Joint pole construction, however, is not the ideal condition from the operating man's point of view. Many wires on the same pole are not ideal. It is true there is no more difficulty in having all the wire on one pole than in having several poles along side of each other, but what I wish to call to your attention is that if the several lines can be routed so that there will not be a multiplicity of wires on the same pole, it will be far better than having 11,000 volt, 2400 volt and 500 volt secondaries of several different companies on the same lead.

Joint pole construction is ideal from the point of the public under certain conditions. It is not the ideal on the part of the operating companies under the same conditions. This is particularly true in territories where ice and sleet are far more prevalent than here and it is largely for the benefit of the other operating companies, who read our discussions that I desire to make these remarks.

Chairman Woodbridge: In joint pole work, as in a good deal of other work, we often deal with other interests, notably the telephone interests. Mr. Warren has spoken to us this morning about inductive interference, and handles much of their relations with other interests, and is qualified to speak also on joint pole work. I will ask Mr. Warren for his views on joint pole work.

H. S. Warren: When Mr. Woodbridge said he would like to have a few words from me on this subject, I obtained a copy of Mr. McDonald's paper and have read it with much interest and find that it sets forth the general phases of the subject very comprehensively and in a way against which I have no criticism. The agreement which is made between different companies entering into joint use is a very interesting document. Of course, primarily, an agreement is a legal rather than an engineering document, but it is one of those things that has to be worked out jointly by the engineers and the lawyers. It has been my fortune to have spent consid-

ject, and while I do not wish to go into it at length, I will mention that it is one of the most interesting, and, I will add most difficult subjects to get on an absolutely equitable basis that I have ever encountered. I have for a couple of years been trying in conjunction with the lawyers to get up some equitable agreements on the several bases that Mr. McDonald mentions, joint ownership, permanent right, rental on the basis of space, rental on the basis of attachments. There are some situations where joint ownership is not regarded as the best arrangement.

The specifications from an engineering standpoint are the most important thing. Touching on the question recently mentioned as to the desirability of joint use, I think it is almost wholly a question of the specifications followed, whether joint use is desirable or not. About 10 or 12 years ago in the vicinity of New York there was a great deal of joint use, which had grown up indiscriminately. There had been no specifications covering it. The companies made attachments on one another's poles as seemed easy and convenient, and the result was that there were not adequate clearances and due regard to safety, and there were a great many accidents. So many accidents, in fact, that the companies took the question up and made a thorough study of it. A committee was appointed of two representatves from the telephone company and two from the electric light companies who worked about a year and got out an agreement and specifications. The specifications have been used very generally by the Associated Bell companies, so that, without any exaggeration, a great majority of the existing joint use is in accordance with that specification. I think substantially the same specification is used in Los Angeles and in other parts of California. That agreement and specifications were included in the report of a committee of the National Electric Light Association five or six years ago, and a very similar specification was worked up by the American Electric Railway Association about 1913 or 1914. This last specification is a little more general than the former one, but, insofar as they cover the same ground, they are about alike and I don't think there is any great difference of opinion on any of the engineering points unless it be that some of the power companies do not see the advantage of the voltage limit. In a general way the telephone company is strongly in favor of joint poles under proper circumstances, that is, with the class of electric circuits used in distribution where the lines of an electric company and the telephone company must necessarily be close together. We much prefer joint poles to conflicting construction.

When it comes to transmission lines of an electric company, there we find a different state of affairs, and I don't think under present conditions that joint use would be desirable, although there may be exceptions. As a general rule the longer lines had better be kept apart as long as that can reasonably be done.

Some reference was made to country distribution this morning. I have not studied that question very fully, as it arises more particularly in the western states, and I am not prepared to give any final opinion on it. However, I should say, if the voltage is high, as long as there is room to keep apart, we prefer to do that, so far as any economic question is concerned. That is, the mere saving in a joint line would not, in my opinion be a sufficient justification for the hazard of going into joint construction with a high voltage line. Of course, if the voltage is low enough so that no especial hazard exists, it would be the same as town distribution and joint construction would be desirable. The various advantages of different methods are set forth well in the paper, and nothing occurs to me in particular to say further except to repeat that we believe fully in joint use for town and city work.

E. R. Northmore: Mr. Macdonald's paper covered the Los Angeles condition very thoroughly, but there are a few points that I want to bring out.

Ten years ago, when joint pole construction was commenced in Los Angeles, there were three electric, two railway and two telephone companies operating on separate pole lines trying to occupy the same streets together. These seven companies formed a joint pole committee and the specifications applied to the conditions at that time, but state laws, railroad commission rulings, changes in the N. E. L. A. specifications, etc., have so changed the construction that these specifications and contract are not now suitable for the work, and our experience has taught us that a joint pole contract should be drawn up to cover every possible contingency and the specifications made so that the joint pole committee can change the specifications as conditions, laws and other changes come up. This joint pole committee in Los Angeles has been working harmoniously for ten years. By co-operating and working together trying to settle the difficult questions that come up by seeing them from the other fellow's viewpoint as well as our own, we have been able to settle practically all questions unanimously.

We have found that our operating and repair cost on our line construction has decreased at least 50 per cent on account of joint pole work. One of the great helps is pole moving made necessary by street improvement work. Formerly the city engineers and the contractor would phone every pole using company in the city advising them that street work was to be done on certain streets and for them to take care of their poles. This necessitated the sending of men by every company to attend to the work. The joint pole secretary is now made the clearing house for all work of this kind. All communications concerning work of this kind are sent direct to the joint pole secretary who, after inspecting the work to be done, makes the necessary recommendations to the companies who are interested in pole moving on that individual street. This prevents the unnecessary trips of the companies who have no poles, or whose poles happen to be in the right location.

I disagree with Mr. Lisberger where he says there are conditions where combination poles are not advisable. I cannot conceive of any proposition where a combination line would not be better than two, three or four lines placed on the same street. If lines get so heavy that they can not be supported on combination poles it is then time to either go underground or string part of your lines on another street.

R. E. Cunningham: Most joint pole agreements, principally the Los Angeles agreement, are on the joint ownership basis. We prefer that arrangement, because once having recorded the combination it takes care of itself as a matter of record after that. But we have had a number of cases where it was necessary to consider a rental basis. This has been the case with the independent telephone companies who don't care to consider the joint ownership agreement. We don't favor the rental agreement because we have each year to check up all the existing joint poles and prepare bills to cover the rental from one company to the other. If there are any men here who have had experience with the rental agreement and who have had a better way of handling the record than what I have outlined, I would be glad to hear from them.

C. O. Poole: I want to raise one question that probably Mr. McDonald can explain, and that is as to how it is working out and is going to work out in reference to franchises. There may come a condition where one company might work itself out of a street entirely and have no rights there. I don't know how that would operate on some of the constitutional franchises. The franchises given today call for specific streets and they can only build on those streets. I can see where it might be possible where one company in some locality might have all the franchises and the other party would have nothing to operate under.

J. E. Macdonald: It is assumed that each company participating in joint pole construction in any location has a franchise to operate in that location. If this is the case,

its rights to set poles or own poles in such location would not be affected by its participation in the joint construction.

The most vital part of the joint pole scheme is that of proper records. The Los Angeles system expanded from less than 3000 poles recorded in 1907 to nearly 23,000 recorded in 1916. The problem is simple until replacements begin to be required, and the fact that the amount involving each pole replaced is small demands an extremely simple method to prove effective. Formerly it was necessary for the committee to make an inspection of all combinations as well as replacements, and as the territory covered a large part of Southern California, the cost of recording a combination pole or a replacement was excessive in some cases. About two years ago, the committee undertook to solve this problem so as to avoid unnecessary duplication of functions by the committee and the companies' employes. Records are now made and settlements effected in accordance with the data furnished to the committee by the companies. The disposition of joint property removed from service is another item which should have special consideration. In many cases the poles removed from service are of little or no value, but it is quite essential that each company should receive its proper proportion of the salvage value. Standard salvage values have therefore been adopted. An attempt is first made to divide the property equally among the joint owners and the remainder, if any, is taken by one of the joint owners, preferably the original owner, and the other companies are authorized to bill against this party for the proper proportion of the salvage value.

Automatic Switch Protection

Chairman Woodbridge: Like Banquo's ghost, the question of protection against overloads will not down. It has been with us ever since distribution started and probably always will be with us. The large eastern companies with their comparatively heavily loaded and shorter feeders have made great developments recently along the line of automatic switch protection with relays. With us the problem becomes more one of fusing the individual service or transformer, which is often miles away from headquarters, requiring long trips to replace fuses. We have obtained for this meeting a paper by Mr. Cunningham, and an expression of views by several members of the committee, all of which have been published. I hope this published matter has been read and that it will develop further discussion at this time.

J. S. Thompson: The Pacific Gas & Electric Company commenced the manufacture of switches, both of the oil and the other types, almost at the beginning of their construction work; and naturally that led to the development of our local manufacturing industries. There are several manufacturers of switches on the coast making both oil and air break circuit breakers. I am going to pass by the oil switch phase of the question and take up with you what would seem to be the more perplexing phase, the protection of equipment by fuses. The oil switch has been brought to a point where it is not a questionable piece of apparatus. It is as satisfactory as the transformer and the generator. The fuse, on the other hand, is quite as distressing as it was in the beginning, and I am sorry to say, as it is now and ever shall be. In the first place, this crude way of protecting apparatus means simply to say, "We will select the weakest part of the circuit and in case of trouble localize the trouble there." And a method of protection that depends on the destruction of material cannot be a very advanced engineering method.

I sell fuses by the thousand. But "I come to bury Caesar, not to praise him." I hope to sell thousands more. There is no more adequate protection within the limits of engineering economy than the fuse for single-phase operation. In multi-phase installations there is the danger of a single fuse rupturing and bringing about a single phasing of the system, though this does not militate sufficiently to prevent protection, with fuses, of the thousands of small installations which do not warrant automatic protection. I say they do not warrant it, but I should say that they heretofore have not. If the only thing I sold was fuses, I would not be here now, because I predict that the day of the fuse has practically reached its zenith, in engineering distribution, and the manufacturer will be forced to furnish low-priced automatic protection down to the most inexpensive equipment in time, and you who operate will be forced to purchase that equipment.

Then we are confronted with the question, what fuses? What means of protection? If there were an ideal material, it would be a material indestructible through fire, with mechanical strength to permit it being dropped from a building without injury, that would be transparent so that the fuse could be inspected. This ideal material has not yet been perfected. Perhaps you will have to wait until the Germans, what is left of them, get back to the laboratories. In the meantime you will have to use material that meets as many of the requirements as possible. Glass has the faculty of being indestructible by weather conditions and heat but it is fragile. Bakelite meets the mechanical requirements and has the features of resisting warping or weathering, but its point of ignition is so low that if the fuse wire is heated up to a point still short of its fusing or melting point, that point could easily be higher than the burning temperature of Bakelite. Therefore it is necessary to put a protective material around the fuse, keeping it away from the fuse tube. This acts in a measure to diffuse the heat and keep the fuse wire from sagging over against the material and setting it afire. But, like the fuse, it is only a makeshift.

The proper size of fuse wire is a matter of vagueness and is incapable of being fixedly determined. A fuse wire surrounded with silica will conduct one hundred per cent more than the same wire exposed to the air. Similarly rated fuse wires, we all know, have different ranges of fusing points, to such an extent that when fuses are ordered by the operating man he orders a fuse very often in which the load that is to be placed upon it is so close to the fusing point that he brings it up to a very high heat, and the result is a slow oxidation of the fuse wire resulting in the gradual reduction of its cross-section and a consequent fusing point much lower than when it was new. These points are almost insurmountable. For that reason I make my optimistic statement that the solution of the fuse is to get rid of it. You have simply this one point: you must have a weak point in your system under the theory of fuse protection, and your aim, of course, is to make that weak point as inexpensive as possible, so that when it is destroyed the minimum of value will be destroyed.

A. Bowie: One of the subjects which I did not see touched on by Mr. Cunningham is the question of branch line protection. The protection of a branch line by fuses has serious drawbacks, because, for the reasons stated, if one of the fuses blows it puts the motors on single-phase, and may burn them out. There is no question but the protection of branch lines will be greatly improved by automatic circuit breakers, which is the only practical means to do this work.

The matter which Mr. Thompson touched on about the fuse and fuse tubes, is of considerable importance in the general design of any apparatus. As far as it is practicable, it is of prime importance to be able at times to look at a piece of apparatus and tell exactly its condition. If you cannot inspect the apparatus, you have to guess at the condition of the contacts and so forth.

Many materials are not as fully investigated by manufacturers as would be advisable. Such for instance, as the matter of creepage of current over materials subject to voltage for a long period of time. There is a strong tendency to go more into the use of porcelain and glass throughout, and to do away as far as is practicable with all other classes of material for high tension insulation. Deterioration of ma-

terials under stress is of prime importance in that connection.

The indestructibility of the apparatus in switch construction is important. The development of the oil switch up to date has finally resulted in the oil itself being practically the only inflammable material used therein, and the oil switch is probably the only piece of apparatus which embodies any material of such a nature. In every other instance all materials subject to deterioration have been eliminated as far as possible.

J. S. Thompson: May I add a word or two? I think I may speak to you a little optimistically on a subject which I did not think of because of my frank pessimism as to one of our products. That is, a switch that we are developing in which an oil insulated member in the form of a plunger is mounted on a line insulator, and a switch blade is arranged to come down and press it into the closed position. This switch has aroused the interest of all the engineers who have seen it. It has the feature of giving the oil break and the air gap so that it will be evidently open, and at the same time the duty of breaking the circuit will be under oil. Part of my pessimism as to the fuse is on account of my optimism in regard to this switch we are perfecting in our factory.

D. J. Butts: A statement was made that the usefulness of the fuse has passed. It seems to me there is still a good service that fuses can perform in protecting high tension or secondary distribution work, i.e., 2000 to 15000 volts. The field is in branch lines.

If all distributing lines could come to a station switchboard the automatic oil switch would afford the proper protection but, owing to the geography and topography of the country, it is difficult to make all lines come to a central point and it is necessary to protect some branch lines at the poles. There is a serious objection to automatic oil switches for this service for the reason that sometimes months elapse when the switch does not operate and being subject to weather conditions and temperature changes anything mechanical is apt to fail when it should work. For cases of that sort a fuse that will open the circuit properly, say from 2300 to 13000 volts, still has a field.

The Western Electric Company is marketing such a fuse and it operates in oil. The fusing link is an aluminum strip about an inch long and supported by spring fingers. As soon as the fuse blows the fingers open out, making the distance between points up to four inches. The fuses operate within 12 per cent of their rating and will open under short circuit conditions rapidly, without injury to the renewable link. The renewal cost is about 12c.

H. A. Barre: I do not like this general tendency toward increasing the cost of distribution by the use of protective devices better than the fuse. The most serious thing we face at the present time, and practically at any time, is the cost of consumers' installation. Recently we had much fuse trouble in a district having a connected load of three or four thousand horsepower and an average size of installation of about ten horsepower. Investigation showed the total cost of replacing these fuses to be about $250. To equip the installations in this district with any of the types of protective devices under discussion, other than the fuse, would cost many times $250. This cost would be prohibitive, even under ordinary conditions.

At present we are facing a situation which will require that all possible resources of the power companies shall be directed to the extension of their distribution systems into agricultural districts. We, in conjunction with the manufacturers, must devote our efforts to meet this condition and reduce the cost of service. We may burn up some transformers and meters, but we must keep the cost down.

L. M. Klauber: There is one point with reference to the fuse situation that I wish to mention as I believe no one has touched upon it. While I am no friend of the fuse, I desire to mention this point because the fuse is often blamed for the burn-outs which should not properly be charged against it. We often have a fuse blown or a transformer burned out and then in investigating we consult the trouble or installation man and inquire. "Bill," how was that transformer fused?"

Says Bill, "Well, the transformer had a full load capacity of 5 amperes, so I fused it up to 10 amperes."

"How did you do it?"

"Well, I didn't have a 10 ampere fuse with me, so I took three 2's and a couple of 3's and added a 5, and then I twisted them all together, because I figured that the combination would be about equal to a 10."

Or some times Bill says, "Well, when we installed that transformer we had used our last fuse, but we found some light copper wire—I don't remember whether it was a No. 12 or a No. 26, but we used it, and I think it ought to hold."

Of course this may be exaggeration, but we found that a lot of our fuse trouble resulted from this sort of improper fusing; so we have made up standard fuse kits consisting of sheet metal boxes with hinged lids. In the bottom of the kit are compartments for holding all sizes of 2300 volt link fuses which the troubleman may require. Above these are placed a set of 11,000 volt expulsion fuses, each size being in a separate waterproof tin cylinder, labeled with a brass tag. Also there are a couple of spare fuse holders. On the inside of the cover of the kit is pasted a schedule showing the proper size of fuse to use for each size of transformer installation. We find that when all troublemen and installation crews are equipped with these standard fuse kits, much fuse trouble is eliminated.

R. E. Cunningham: I believe that all of our experience goes to show that fuse troubles increase almost as the square of the voltage. I certainly am sure we have more trouble with the high voltage fuses than the low. Take the fuses on 110 or 220, and nobody would think of trying to use any other protection for those small loads. But with the scattered load which we must serve in the rural districts, we must use higher voltage for the distribution circuit, and my contribution has been on the 11,000 volt system. For 3-phase power loads of considerable size you will have to plan a little more protection, if it can be found, than the fuse protection. The oil switch which is described in the article, I believe, is only one method which could be worked out. I have told a number of manufacturers' representatives that I believed some automatic air-break system could be worked out, although I could not tell them how to do it, but I believe there are other methods which could be worked out. In the matter of 3-phase transformers, we propose to use these transformers on the 11000 volt circuits to keep down our expense of distribution and installation. From the curve shown in the paper you can see that there is a saving, and I believe if the other member companies would adopt the use of 3-phase transformers and bring them into general use there would be further reduced cost from what is shown by these curves.

Standby Stations for Hydroelectric Power

Chairman Woodbridge: In the matter of steam stations, our service is usually a standby to hydroelectric power, making the operating conditions of our steam stations very different from those which are carrying the whole load. Mr. Morgan has given us a very good paper on the operations of the Redondo station under such conditions. One of the main questions that arises in such operation is how closely can steam be cut off in a steam turbine without difficulties or danger to the turbine. There is no better synchronous condenser, as a rule, than the steam turbine installed as a standby. In general, the turbine without load, has ample capacity for over excitation. Difficulties have been experienced when the steam has been cut off altogether, due to the over-heating of the turbine blades. Several companies have tried it, and I believe we should get a comparison of

the results because the results of one company are generally different from those of another, and some companies have very different views from others on the subject. The San Joaquin Light & Power Corporation has operated turbines in this way and I would like to ask Mr. Quinn for the results of their experiences.

E. A. Quinn: We operated a 2000 kilowatt Curtis horizontal turbine without steam. When the turbine was synchronized, steam was cut off. The hand hole plate on the low pressure portion of the steam end was taken off. On the high pressure end there are two small hand hole plates. These were removed and air piped to them from the generator air chamber through four 1½ in. pipes. The highest temperature recorded was 280 deg. F. Turbine was operated as a synchronous condenser for about four years without cooling by steam and apparently blading was not damaged. The machine is now being used as a generator.

W. J. Davis: It is often very desirable to be able to operate steam turbines as synchronous condensers for regulating the voltage of the system. In so doing it is necessary to pass a small amount of steam through the turbine in order to carry off the heat generated in the blading by the rotation losses. In several cases brought to my attention, turbo-generators have been operated as regulators without steam with the object of saving fuel. Two methods have been employed. In one, an inspection plug in the turbine casing has been removed, the turbine blades revolving in air at atmospheric pressure. In the other method, a vacuum is held on the turbine and condenser by operating the air pump, but the throttle valve of the turbine is kept closed. In both of these cases, excessively high temperature of the blading will result, with the possibility of serious damage. When the blading is rotated at full speed in air at normal pressure, high temperatures are caused by abnormally high rotation losses. If rotated in a vacuum of 28 to 29 inches, the rotation losses are greatly reduced but not entirely eliminated, as it is impossible to obtain a perfect vacuum, and even a very small rotation loss will result in high temperatures because there is no medium for carrying off the heat. The condition would be similar to that of an incandescent lamp.

These high temperatures cause the bronze blading to become brittle and to crack and there is also a loosening of the blading in the dovetails which will eventually lead to trouble.

The amount of steam required to keep the blading cool is small and will probably not exceed a thousand pounds per hour in most cases, when a good vacuum is maintained.

In rare cases, the cost of maintaining steam might be so great as to materially exceed the cost of reblading the turbine periodically, in which case the operating company might be justified in running a turbo-generator as a synchronous condenser with the throttle valve closed. I am inclined to believe, however, that even in these cases, a properly designed synchronous condenser would prove better in the end because of its greatly superior efficiency.

P. M. Lincoln: I am not prepared to speak with a great deal of knowledge on this, but I do know of a number of cases where turbines are being run successfully as synchronous condensers, but in none of the cases that I know of are the turbine blades operated at atmospheric pressure. In all the cases I know of there is a sufficient amount of steam kept running through the turbine so that a reasonable amount of vacuum is obtained and the blades are rotating in a vacuum. When this is done there seems to be no reason to believe that there is sufficient temperature developed to fear on that score.

Another objection that occurred to me to operating the trbines with atmospheric pressure, is the loss that is bound to occur when that is done. I don't know just what that would be, but it is quite evident that losses that would take place in the blading would be high and consequently the operation under that condition must be carried on at a considerable loss. One of the systems on which steam turbines are being successfully operated as condensers is that of the Southern Power Company. They have several turbines on their lines at various points and are operating them as synchronous condensers. I cannot name any others at present, but I do know that it has been done to a considerable extent.

J. A. Koontz: I don't know that I can give you any accurate detail of our method of operating on the Great Western System. I have not followed it very closely. For the past two or three years we have "floated" a station in Oakland, and a good deal of the time under vacuum, and without steam. To take care of the absence of steam for the auxiliaries (the dry vacuum pumps being normally steam-driven) we operated them on compressed air, having a motor-driven air compressor of sufficient capacity in the station. To date I don't know of any serious trouble. At one time we had numerous thermometers placed as well as we could judge over the turbines, with the throttle closed, and we got a sudden shutdown and opened the valves wide open to carry load and the heat broke all the thermometers. So the thermometers were either not giving us any idea of the temperature when running without steam, or something else was wrong. We lost all the thermometers, when the superheated steam was put through the turbine at 200 pound boiler pressure. Mr. Davis is entirely familiar with this installation and he has been in closer touch with it than I have. I don't know that there was any deterioration of the blades.

W. J. Davis: In a great many plants, turbo-generators are operated as synchonous condensers but in nearly all cases, it is customary to allow a small amount of steam to pass through so as to carry off the energy losses in the blades. Mr. Koontz's experience has been fortunate and unusual because his turbines have blading of steel and Monel metal which is capable of standing a very high temperature without injury. My experience has been that injury will ultimately result if no steam is used as it is not feasible to measure the actual temperature of the blades. All we can do is to periodically examine the blading to see if there is any loosening in the dove-tails or shrouding, or whether the metal has deteriorated in tensile strength and elasticity.

J. A. Lighthipe: The great source of losses in running steam turbines as synchronous condensers is the fact that you have all your auxiliaries working with steam. But the modern system when you are using the turbine as a standby is to have all the auxiliaries motor driven. Then the amount of live steam to keep the turbine cool is very small. I think that is the trouble with most of them—that they use steam in circulating the water and running all the auxiliaries necessary. That is where the live steam goes to. If they were all motor-driven and the steam used absolutely went to keep the turbine cool, I think it would be very small.

J. A. Koontz: I would like to ask one question. No doubt motor-driven auxiliaries are advisable from the standpoint of economy in standby stations. But where we are attempting to standby to give A-1 service, the minute the system is in trouble the auxiliaries are also in trouble. We operate another turbine station in San Francisco, which with its load we cut loose from the hydro system in case of trouble, and the synchronous sets do not fall out of step.

But in other stations where we attempt to hold any load we are not able to do that. Wherever we attempt to use motor-driven auxiliaries we only magnify our troubles, and I was wondering whether Mr. Lighthipe had any particular means of overcoming this trouble.

Mr. Lighthipe: My steam would cut itself loose, that is all.

The Chairman: The paper covered a great many other phases, particularly the organization and so forth, of picking up loads in emergency and in a hurry. Some of the other companies are up against the same problem, and the Pacific Gas & Electric Company in particular has developed it to a

high point of effectiveness. Mr. Eastwood who has charge of one or more of their stations tells me that their station A in San Francisco as a rule will pick up 18,000 kilowatts instantly, and has done it. I would like to hear how he does it.

P. M. Downing: In the absence of Mr. Eastwood, I think, perhaps, I can answer this question. In the discussion thus far regarding the use of turbines as synchronous condensers one important point has been lost sight of. Turbines are installed not that they might be used solely as synchronous condensers, but primarily to carry load when trouble occurs on the transmission lines. They must be ready to pick up load on a moment's notice, and anything that might damage the machines, or make them unavailable for use when needed, should not be done.

On the system of the Pacific Gas & Electric Company the turbines float in on the transmission system the greater part of the time. We do not attempt to operate them without steam. The loads carried range between 5 and 10 per cent of the full load capacity of the machine. When you consider that they are ready when called upon to pick up full load on instant notice, the fuel consumption we do not consider excessive in view of the guarantee of continuous service. In San Francisco at the present time, approximately, 80 per cent of all of the power supplied comes from transmission sources. In cases of transmission line trouble the turbines are separated from the transmission line and pick up the load without the consumers knowing that trouble has occurred. While they are operating as synchronous condensers the field excitation is adjustted so that when they pick up the load and are separated from the transmission system, no great amount of field adjustment is necessary; in other words, we have found it inadvisable to carry the excitation on these machines operating as condensers very much higher than would be required if they were operating as generators. By operating in this way there is less disturbance to the voltage when separating than there would be if it were necessary to readjust the field excitation.

We have two routes over which energy from the transmission system can be supplied into San Francisco, one from the south by the over-head lines coming up the San Mateo peninsu'a, and the other by submarine cables across from Marin County. Both of these are supplied from the same inter-connected net work of transmission lines, but they are not tied together through the cable system in San Francisco. Ordinarily there is a slight phase displacement between the two due to the different characteristics of the lines supplying them. Separate turbines operate in parallel with each line and the two circuits. In other words, these two are therefore tied together in San Francisco only through the boilers. The advantage in operating in this way is that trouble, on one end of the system rarely effects the other end, and we are thereby able to obtain the same guarantee of continuity service by using fewer boilers.

R. J. C. Wood: Mr. Chairman and gentlemen, so far we have on'y heard about the turbine and its ability to carry load, and how much steam it should have. But the real fun begins in the boiler room when a sudden call for power comes upon you. Mr. Morgan's paper shows that if the boilers are practically cold and just carrying sufficient steam to supply the auxiliaries—I think he carries them on one boiler—that he can pick up about 5000 kilowatts in one minute. Now, if you have been carrying even a little load you can do a great deal better than that, and you can pick up in our case eight or ten thousand kilowatts almost instantly from a previous load of 4000 kilowatts, which does not mean that our plant is working any better than his, but that our conditions are different. If there was some way of keeping the brick work in the boiler hot without burning too much oil, half the problem would be solved. The stored heat in the brick work of the boiler is about 25 times the stored heat in the water, and the main trouble in getting up quick steam in the cold boiler is that you cannot get perfect combustion. You try to get a lot of oil in, and all you do is fill the boiler with soot. For that reason I think the electric auxiliary is the right line to pursue. In Mr. Morgan's case you have one boiler taking care of all the steam, and when the trouble call comes that boiler is not available for carrying load purposes, and you have to depend on your cold boilers to supply the load. If you have electric auxiliaries you can carry a minimum load on your turbine and shift your fires from one boiler to the other to keep them all comparatively hot, and then when your trouble comes you can pick up load much quicker. With regard to the by-pass valve which Mr. Morgan installed, permitting a small amount of steam to pass through the turbine all the time, we had considered a slightly different arrangement, which would be to shift the cams on the governor shaft so that there will be an interval between the first cam and the second cam, regulating the drop of speed to two per cent between the first and second valve. The turbine would operate on the first valve unless something happened on the system to drop the speed 2 per cent, and then it would go on the rest of the valves as if nothing had happened. This arrangement would relieve the operator from watching all the time to keep the load at the minimum value. But Mr. Morgan's device has the advantage of being put into actual operation and ours has not, and thus ours is only a matter of theory. I notice he tests out the over-speed tripping device once a week. We have had some experience with the tripping device which has not caused any trouble, but which has led us to consider it advisable to test it out every time we shut the turbines down, in fact, that is the way we shut them down. We speed them up until the trip comes out, and we have found a sufficient number of times that we had to speed up higher than we anticipated and so we believe that that is a very good insurance to operate in that way.

Mr. Morgan does not say anything about condenser tube corrosion. I was wondering if he had found any more corrosion on standby than during normal operation, or whether the corrosion is proportional to the number of hours the turbine is run.

I think we owe a debt of gratitude to Mr. Morgan for writing a paper of ths kind, because we never get enough of these papers telling us about our troubles. I think every one will agree that the standby plant is a trouble. At the end of the month a lot of money has gone out and nothing tangible received for it.

Heat Insulation for Boilers

Chairman Woodbridge: Mr. Wood has brought up the question of the amount of heat that should be stored in the walls of the boiler and which must be stored before you can get good combustion. That immediately brings up the question of thermal insulation of the wall. I understand that there has been work of that kind done, and I would like to call on Mr. Russell.

S. P. Russell: Our company is insulating a great many boi'er setting walls. This is not only to save the heat transmitted through the boiler wall, but to store up more, heat in the brick work (which is very important in a stand-by plant, where it is sometimes necessary to instantly pick up a load, 25 to 50 per cent greater than the normal rating of the boiler plant), and also to secure greater efficiency by eliminating infiltration of air through the brick work of the boiler, thus increasing the per centage of CO_2 content of the flue gases.

I understand the Pacific Gas & Electric Company increased the efficiency of their boilers about 5 per cent by insulating their boiler settings, and it is because of the vast amount of heat stored up in their boiler settings, by this insulation, that they can instantly pick up a load of 20,000 kilowatts, without any material drop in their steam pressure.

Chairman Woodbridge: Is this heat insulation outside of the wall, or, is it inside or between different sections of the wall, thereby cutting off part of the wall?

S. P. Russell: It would allow the boiler wall to store more heat, if on the outside of the brick work. It might also be placed on the interior of the brick work, if you can arrange for it, at the time of the construction of the boiler work, placing it between the fire brick and the red brick, but you would lose the advantage of storage capacity of the red brck.

G. C. Wood: I am very much in favor of having an air tght casing on the outside of the boilers to stop air leaks. But it seems to me if you put a perfect heat insulator on the outside of your brick and then run your boiler long enough, you will have the case of the turbine blades and the filament of the lamp, and the brick will lie a molten puddle at the bottom. We have considerable trouble now with brick deterioration. The only thing that stops the fire brick from melting all the way through is the loss of heat from the outside. If you stop that you are going to melt your brick all up.

L. M. Davis: I know one case in one of the standby plants on Second and Townsend. This plant was built by the city for the water supply system and was only to be run in connection with the regular high pressure system. All of the boilers in this plant are covered with two inches of non-conducting material outside. It was found that steam pressure could be kept up on each boiler at the expenditure of one barrel of oil a day.

C. O. Poole: We operated our steam plant at San Bernardino at the end of our transmission system as a standby plant for a little over three years. We ran one of our sets as a synchronous condenser. We got very satisfactory results in the operation of the condenser for regulating voltage. We used in the plant at that time two boilers, two 500-horse power Stirling boilers, and we keep them up to 175-pound steam pressure, using 30 barrels of oil per day. We could not find any deteriorating effect due to the operations. Under ordinary conditions we tie in with the Southern California Edison Company, and we shut the steam plant down and keep two of our boilers filled up with water for any emergency that might come outside of what can be taken care of by the plants in operation. It takes us about three hours to get steam up when we have to do it. Of course, that is a disadvantage.

Don Mongan: Mr. Chairman and gentlemen, in the Redondo plant our case is a little different from some of the others. Mr. Davis of the General Electric Company has recommended that the best thing to use was a condenser manufactured for that purpose, and not to use a steam turbine. We are trying to accomplish two things with the steam turbine. One, an emergency standby feature as well as getting the condenser effect, although the turbine is not operated except at such times as it is needed as a condenser. In our case, we feel that we accomplish two purposes with one piece of apparatus.

Another point brought up was in reference to electric auxiliaries instead of steam. In the event of a complete shut down of the hydraulic source of supply, steam auxiliaries are almost necessary to get your turbine quickly into service. Of course, there is a loss of steam which is a very considerable item when the turbine is operating as a condenser only.

We had intended to operate the turbine as a condenser without any steam, but we got cold feet on the matter and took it up with the General Electric Company; they advised strongly against it, and we finally worked it out as mentioned in the paper.

Some of the data in connection with our tests had been lost, the chief engineer was asked to duplicate tests. With the turbine connected to the line, he closed the throttle and found he was getting the same temperatures as the tests we made sometime ago with the by-pass throttle partly open. It was evident that there was sufficient steam leaking by the throttle to supply all that the by-pass throttle would take. This was not only apparent from the temperature of the blading but also from the indications of the integrating watthour meter. I am wondering if some of the experiences related here in reference to operating turbines as a condenser with the throttle closed are not similar to this experience and that as a matter of fact, they were giving the turbine considerable steam on account of a leaky throttle.

Another point brought up was as to the cost of operation under these conditions. We spend approximately $10,000 a month which is principally in the way of insurance and there is a lot of oil used and nothing to show for it. During the summer season the station output is a minus quantity due to the energy required for electrically driven auxiliaries, and the dry out of the generators.

Mr. Wood brought up a point in reference to troubles in the boiler room and I fully agree with him. The boiler room is the hardest place to get along with any degree of speed. When an emergency arises, if the boilers are cold, you get nothing but a cloud of black smoke through the stack, and very little improvement can be made until the plant is thoroughly warmed up. We are not attempting to hold the full output of the Redondo plant for standby purposes, the intention is to be able at all times, to pick up the commercial load.

Employment of Engineering Students

Chairman Woodbridge: This discussion practically concludes the consideration to be given to the papers that have been prepared for this convention.

We have one matter of business left over from this morning, brought up by Prof. Scrugham. If he is here I would like to hear from him.

J. G. Scrugham: The N. E. L. A. Committee on Relations with Educational Institutions desires to call your attention to the matter of employment of engineering students during the summer months. We suggest that their services can be utilized to advantage by practically all of the member companies of the association. A circular letter on the subject has been sent to most of the officials present at this meeting. The Electrical World is conducting a department of electrical research under the direction of Prof. V. Karapetoff. I believe that we should actively interest ourselves in the matter, by recommendation of certain specific problems for research. The chairman, Mr. Woodbridge, has made some suggestions which I would like to have discussed.

Chairman Woodbridge: Research along two lines came up this morning, one the life of porcelain insulators, and the other various factors involved in inductive interference. I should like to have suggestions for any other research work that might be considered and referred to Prof. Scrugham and Prof. Karapetoff. In the absence of any other suggestions. I would like to have the meeting take some action on this matter.

H. A. Barre: I move that the subjects that you have mentioned be submitted for research.

(Said motion is seconded and carried.)

Chairman Woodbridge: I think a motion also would be in order thanking those who have prepared papers for this convention. The committee was a little slow in organizing and we did not have very much time after it was appointed.

J. S. Thompson: I move that a vote of thanks be extended to the gentlemen who prepared papers.

(Said motion is seconded and carried.)

The great value of electricity and the possibility of its generation and distribution on a large scale in the modern stage of technical progress in a land which has an abundant supply of water power, coal beds, and peat bogs have gradually created the conviction that this is a matter in which the government itself should take an active part with the object of promoting economic welfare.

SHORT JOURNEYS IN PACIFIC LANDS

(Our Pacific neighbors continue to contribute their share of interest to those who look ahead a decade or two and picture to themselves the new world that will be upon us at the conclusion of the present world war. National phenomena unknown to American practice must be dealt with and the commercial customs of new and strange peoples analyzed. Here are some observations made by representatives of the Journal of Electricity in foreign lands, the first by the editor of the Journal, while on a recent tour of the Orient, and the second by a well-known Pacific Coast engineer now making a tour of the West Coast of South America in an endeavor to size up possible future commercial and engineering relations with our neighbors to the south.—The Editor.)

The Loss and Gain of a Whole Day at Sea

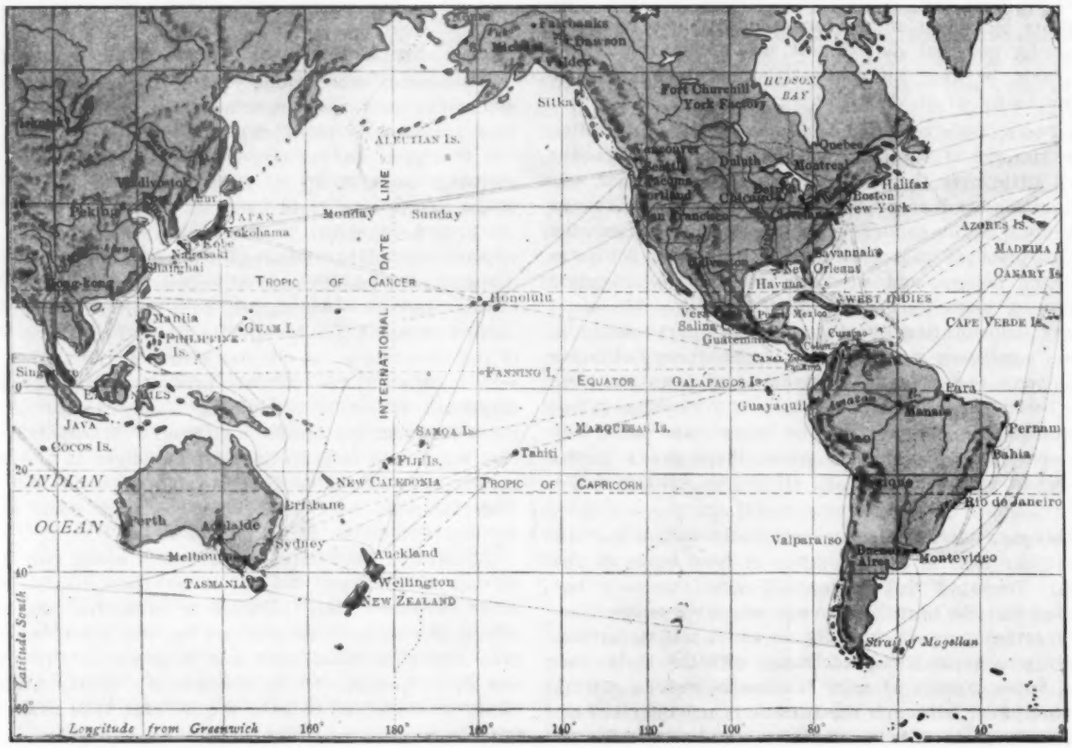
The engineer of the Far East who desires to file reports simultaneously with certain reports of the home office has another phenomenon of the mid-Pacific to bear in mind—namely that of the loss or gain of a whole day at sea.

As the traveler sets out by rail on a westward journey from New York, the porter usually advises him each morning to set his watch back an hour, for the rapid motion of the train counteracts the motion due to the rotation of the earth; hence, a daily correction is necessary.

In traveling across the Pacific a peculiar incident occurs about midway between Honolulu and Yokohama. The hands of the clock having been set back so often, have in fact lost a whole day of twenty-four hours. In a word, a place is reached where the end of one day and the dawning of another are simultaneously taking place. If for instance the day you have just been living is Thursday, you now find that Thursday commenced at this place just twenty-four hours previously. Hence in order to make the proper correction you find yourself at midnight Thursday evening beginning the morning of Saturday, with no Friday in between.

Many a man has longed in his soul to live his life again. To a certain extent this opportunity is granted him upon his homeward trip for the correction is made in the opposite manner, and one is compelled to live the same day twice. As if Divine Providence were forcing upon us the solemnity of the point at issue, our day proved to be Sunday, July 5th. So that, having enjoyed the celebration of a glorious Fourth of July at sea, two Sundays, the one following upon the head of the other, were granted us for religious services, peace, and rejuvenation.

Coming back again to the engineering considerations of this losing and gaining of time, we see in conclusion that one should bear in mind the transposition of dates. Otherwise, happenings in the Orient and Far East may bear upon the cable message or file sheet, a period of a whole day in the home office prior to the real happening of the event in the far country where the work is being prosecuted.



THE GREAT COMMERCIAL AND ENGINEERING ARENA OF THE FUTURE—THE LAST NEW WEST
The international date line shown on this map explains why engineering cable reports often appear on the Pacific Coast, bearing a date that would make the event appear as happening a day before it actually takes place. Countless other new and strange reckonings must be made by the engineer of the future who would engage in business and engineering enterprises with our neighbors that inhabit these promising fields of future endeavor.

THE ENGINEERING AND COMMERCIAL OUTLOOK ON WEST COAST OF MEXICO

BY J. W. FINCH

Some years ago a street car system was installed in Mazatlan consisting of one open car seating about twenty-five people and drawn by two diminutive mules. This car service has been suspended and transportation about town is by means of two-wheeled carts called "Aranas" drawn by a small mule or horse. The tariff is $1.00 an hour Mex. or 60 cents American gold. Another common means of transportation is an open carriage or barouche drawn by two mules or horses. The charge is about double that of the carts, but they are very comfortable. Up to about thirty days ago there were very few automobiles in the city of Mazatlan, although the population was formerly about thirty thousand and is now about fifteen or sixteen thousand. A fleet of eight Ford automobiles was purchased by one man and when delivery was made about thirty days ago, they were placed in rent service. These machines seem to be popular and many of the natives are enjoying their first rides in automobiles. There are now probably fifteen automobiles in the city and an exceptional opportunity exists here for a garage (there being nothing of the kind here at the present time) carrying a complete line of supplies and the agency for a cheap automobile together with one of a higher grade. Streets and roads are very poor and narrow, but among certain classes there seems to be plenty of money for luxuries, as they look upon the automobile now.

If one is willing to risk his judgment as to the stableness of the present Mexican government there are opportunities for investment in Mazatlan and vicinity for residential lighting. Service is good and the only reason for the limited use is lack of aggressiveness on the part of those who hold this concession. The electric light plant offers another opportunity. There are evidences that electric light and power was used quite generally before the revolution. The service, now, however, is very poor and many services have been disconnected. The electric light plant is not in the best of repair and funds are lacking with which to make needed improvements, primarily because, as the manager of the plant stated to me, a large majority of the consumers have not paid their bills for over two years. This condition, however, is rapidly changing and if this plant were in the hands of some real live energetic American, who knew what service meant and would make the needed improvements in order to put the plant in shape to give uninterrupted service, it could be made a very profitable utility.

The traction situation offers still another opening. The railroad station is about two or three kilometers from the center of town, and all rail freight, of which there is a great deal, could undoubtedly be handled in connection with passenger business. It now costs $1.00 gold to ride from the center of town to the station and return. Freight is delivered to the business houses in mule carts and is expensive. Among other commercial lines there are also opportunities, particularly for the specialist. Business of all kinds is done very differently from our method. To be successful here, one must conform to the customs, must take life very slowly and easily, must open negotiations today and complete next week, what would ordinarily be done in a few hours in the United States.

Even though peace reigns in this section of Mexico, I would not advise the investment of American capital in these enterprises without very careful investigation and some assurance from our own government that such investment would be protected. The Mexican government is new and and while the opinion prevails here that its purpose and objects are sincere, there is still a lack of confidence that is noticeable.

ENGINEERING NOTES FROM PERU

One of the principal industries in Peru is undoubtedly the production of copper, and the largest producer in that country is the Cerro de Pasco Mining Company, with offices in Lima and New York, and with mines located 200 to 400 kilometers from Lima, Peru, up on the Andes Mountains, all of which are located above 14,000 ft. elevation. When this high elevation is considered it will not be hard to realize the difficulties connected with the mining of the ore. The fuel cost is necessarily high, as a good deal of what is used in mining and smelting the ore is brought up from sea level. Lifting the weight of the fuel through this distance requires much power, and is therefore expensive. Another item that goes to make up the total cost of production is the cost of labor and superintendence. That this item is particularly high in this case is also due to the high altitude, as good men must be paid yearly twice as much as they could expect to get in other localities more adapted to their constitution. Then, too, it is not possible for a white man to work as hard up in the rarified air as he can at sea level. The Indians who have lived up there for generations, of course feel at home in the air as it is, and can physically stand the hard labor, although by inclination they do not do it if they can help it. These Indians are built to suit the place. They have a chest twice the size of an ordinary man who has lived at sea level all his life, and it is said that if they go down to sea level, where they have no use for their big lungs they are very liable to get consumption.

ELECTRICAL OUTLOOK IN JAPAN

According to an article by Chugo Ohira in The New York Evening Post, it was only until recently that electric power in Japan has been used largely for the purpose of lighting and running tramways, its use as motor power in general industries being seldom employed. But in the last few years, especially 1916, the cheapness of electric motor power in comparison with coal, and the impetus given as a result of the European war to Japanese industries in general, have brought about a great change and at the end of last year various industrial enterprises were utilizing in their plants 600,000 kilowatt motor power. Most conspicuous, however, is the phenomenal progress made in the electro-chemical industry. From 28,000 kilowatts, which constituted the total power used for chemical enterprises at the end of 1915, the figure jumped, in the course of a year, to 58,000 kilowatts. And the future is very bright; the authoritative estimate tells us that should one take into account the enterprises under way and in contemplation, the total would be more than 160,000 kilowatts.

RECENT ADVANCES IN WESTERN WATER LAW

BY A. E. CHANDLER

(Riparian rights or the water rights of owners of lands bordering streams, lakes and rivers throughout the West have caused endless litigation and in countless instances the development of a whole district has been thwarted by the exercise of these rights. To such an extent has this been true most authorities today agree that it would have been far better in the beginning of things had these landed owners been allowed to possess no right in the waters due solely to the chance location of their property on valuable waters throughout the West. Here is an article by a member of the California Water Commission which speaks authoritatively on recent cases and statutes that relate to this perplexing question of riparian rights.—The Editor.)

RECENT CASES AND STATUTES RELATING TO RIPARIAN RIGHTS

BY A. E. CHANDLER

Since 1905 various attempts have been made in the State of Washington to secure the passage of a "modern water code" in line with such legislation in other Western States. Prior to the 1915 Legislature a commission of seventeen, appointed by the Governor and representative of the entire state, drafted a bill which failed to pass. The bill was reintroduced at the 1917 session and in an amended form has become a law. The principal amendments were in regard to the provisions of the bill affecting riparian rights, as the commission's bill practically abrogated the doctrine of riparian rights so far as future use is concerned. As passed, the only reference to riparian rights is the following from section one: "Nothing contained in this act shall be construed to lessen, enlarge, or modify the existing rights of any riparian owner * * *."

Longmire v. Yakima Highlands Irr. & Land Co. Washington, 163 Pac. 782.

The Supreme Court of Washington has closely followed the Supreme Court of California in its decisions on riparian rights. The Longmire case deals with the vital question of the right to store flood waters for use in irrigating non-riparian lands when in conflict with riparian owners. The defendant was constructing a reservoir to impound the flood waters of Wenas Creek, on the east slope of the Cascade Mountains in Washington. Below the reservoir site the creek flows between low banks through a narrow, level valley. The floods occur from February to May and the valley lands are usually overflowed and sediment deposited upon them. During some years the creek does not overflow but does rise sufficiently to flow through natural depressions extending from the creek in various directions through the riparian lands.

The defendant tried to distinguish its case from Still v. Palouse Irrigation and Power Co., 64 Wash. 606, 117 Pac. 466, which case follows the rule laid down in California in Miller & Lux v. Madera Canal Co., 155 Cal. 59 (holding that the riparian owner is entitled to restrain any diversion which will deprive him of the customary flow which is or may be beneficial to his land and that he is not limited to any degree of reasonableness). An effort was also made to have the California case of Gallatin v. Corning Irrig. Co., 163 Cal. 405, 126 Pac. 864, followed, and the rule applied that the flood waters could be diverted for use on non-riparian lands where they were of no substantial benefit to the riparian owner. The trial court, however, found that the annual impounding of water would diminish the water flowing onto the lands of the riparian owners approximately in the amount impounded and would work substantial damage by diminishing the lateral subirrigation and the fertilizing of such lands. As the Supreme Court felt obligated to accept the finding on the evidence presented, the Gallatin case was distinguished, the Still case followed and the storage enjoined. It is therefore clear that the way of the appropriator in Washington is hardly less free from conflict with riparian owners than in California, except that the tendency is far more pronounced in California to hold that the riparian owner may restrain any diversion by an appropriator **without showing damage**, upon the broad doctrine that the taking itself is an interference with his free-hold which he is entitled to restrain lest it ripen into a prescriptive right. In the Longmire case the Washington Supreme Court specifically holds that the controlling question is whether the impounding of the flood waters would work a substantial injury to the lower riparian owners.

The Hawson Bill

The 1917 California Legislature passed a measure, generally known as the Hawson Bill, which should materially assist appropriators in injunction cases brought by riparian owners. The act provides that in an action brought by a riparian owner to enjoin the diversion or use of water by an appropriator, the latter may set up in his answer that the water is for the irrigation of land or other public use and also set forth the amount to be diverted, nature, place and time of use and show by reference to the discharge of the stream that the proposed diversion may be made without interfering with the actual and necessary uses of the plaintiff. The answer must also state that the defendant desires the court to ascertain and fix the damages, if any, that will result to the plaintiff or to his riparian lands from the diversion. The act further provides certain details regarding the trial and appeal, if desired, after which upon the acceptance by plaintiff "of such amount so awarded or upon the affirmation of such decision on appeal so that such judgment shall become final, the defendant shall have the right to divert and appropriate from such stream, against such plaintiff and his successors in interest, the quantity of water therein adjudged and allowed."

Half Moon Bay Land Co. v. Cowell (Cal.), 160 Pac. 675

It is apparent from the above that the question of the limits of riparian land is an important one. The

generally accepted rule is that lands to be considered riparian to a stream must be within its watershed. From this it is often argued that lands cannot be riparian to a stream unless they drain into it. The Half Moon Bay case deals with San Vicente Creek in San Mateo County, California. The defendants argued that a certain tract was not riparian because its slope was such as to carry water away from the stream. The land in question lies in the flat territory bordering upon and with a general slope towards the ocean. The court called attention to the fact that in delta land situated near the mouth of a stream the water in the stream is often higher than the adjacent land, and said: "It would be an extremely unwise and unjust adherence to a supposed rule to declare that land thus made to slope away from the stream is thereby deprived of the riparian character and rights."

The Half Moon Bay case is also noteworthy for its enumeration of the points to be considered in deciding upon a reasonable apportionment among riparian owners, as each riparian owner is entitled to a reasonable use of the waters of the stream. No comprehensive rule has ever been laid down, as it is held that the concrete facts presented by each case must be separately weighed. The points to be considered include the length of the stream, the volume of water in it, the extent of each ownership along the banks, the character of the soil owned by each contestant, the area sought to be irrigated by each, the practicability of irrigation of the lands of the respective parties, the expense thereof and the comparative profit of the different uses which could be made of the water on the land. It is held in this case "that when the water is insufficient for all the land or for all of the uses to which it might be applied thereon, and there is enough only for that use which is most valuable and profitable, the shares may properly be limited to and measured by the quantity sufficient for that use, and the proportions fixed accordingly." On account of the steep hillsides involved in the case, the trial court found only a small portion of the riparian lands were suitable for profitable irrigation, and the finding was upheld.

This case also emphasizes the rule that a riparian owner who is not using his share of the waters of a stream has no right to object to its use by another riparian owner on riparian land.

Horst Company v. Tarr Mining Co., 53 Cal. Dec. 229

Under the caption "Loss of Water Rights" published in the issue of the Journal of May 4, 1912, the present writer stated that he believed that the current idea that an appropriator by diversion and use for five years secures an absolute right as against lower riparian owners was erroneous. This statement was based upon decisions of the California Supreme Court made at that time indicating that the diversion by an appropriator will be allowed in all cases where injury, either present or future, would not be done to riparian owners. As one of the basic factors of an adverse right is that such right must be used to the damage of the one against whom it accrues, it was believed that a diversion which did not directly damage the riparian owner could not be considered adverse. The Horst Company case clearly shows, however, that the "current view" is the correct one.

In this case the lower riparian owners attempted to enjoin the upper appropriators, who had been diverting the waters of Bear River for upwards of fifty years, on the grounds that the diversion had only recently and within five years of the initiation of the suit deprived the riparian owners of the natural flow of the stream. The court held, however, that the plaintiffs were entitled to the full flow of the stream by their lands at all times and that any taking above to non-riparian lands was an invasion of their rights, whether they used the water or not, and regardless of the fact that the water remaining in the stream may have been sufficient for their needs and uses. The diversion for five years, therefore, gave the appropriators "a perfect title in fee, good against all lower riparian proprietors * * *." The case is especially strong on this point, as the plaintiffs claimed that the defendants in former years had brought from other sources and emptied into Wolf Creek, a branch of the Bear River, water equivalent in amount to that diverted from the main stream and that for this reason the natural flow of the stream at plaintiff's land was unaffected.

NOTES ON RECLAIMING ALKALI LAND BY ELECTRICAL PUMPING AND OTHER METHODS

In expressing an opinion for the Journal of Electricity on the recent drawing of the Kearney Vineyard by means of electrical pumps and other methods employed by the University authorities, Professor S. T. Harding of the civil engineering department of the University thus compares the various methods:

The saving in power requirements would hardly seem to be sufficient to warrant the additional construction cost of the tile drains under the conditions existing in this area. The tile drainage method has, however, been demonstrated to be successful in restoring the land to productivity. The sump method has not been used sufficiently to demonstrate its effectiveness on a large scale, although a development such as that outlined by Mr. Hill should be successful in lowering the ground water below the point of injury. Mr. Weir recommends lateral drains 400 ft. apart and 7 ft. deep. A sump drawing the water to a depth of 30 ft. would drain 200 acres if it lowered the water over a radius of about 1/3 of a mile.

A noticeable feature of both methods is the character and amount of the power load of such plants. The Kearney vineyard plant is equivalent to 1 horsepower for each 20 acres drained, the load factor for a six months' season being nearly ninety. The sump method using 15 horsepower per plant is equivalent to 1 horsepower for each 13 acres drained if a plant is used for each 200 acres. The sump plants would have a similarly high load factor.

These methods illustrate the possibilities of drainage by means of pumps in areas having small slope where gravity outlets can not be economically secured. The tile drainage method can be adapted to all types of soil. The sump method is suited to those more open soils where the effect of the drawdown at the sump will extend over a relatively large area, a condition which is found in this area.

SUGGESTIONS FOR CONTRACTOR AND DEALER

DEPARTMENT CONDUCTED BY GEORGE A SCHNEIDER

(Service is the watchword of the hour these momentous days in our national life. Here is a discussion that tells how better service will make for better success in the contractor-dealer's experience. Technical hints on direction of air flow from ceiling fans, notes on wiring diagrams and a discussion on the standard direction of rotation for electrical machinery follow—all of which should prove helpful. The author is power apparatus specialist for a well-known electrical supply house in San Francisco in which position he is constantly employed in solving just such problems as these.—The Editor.)

SERVICE.

In these days of big business, we hear a great deal about service. Business philosophers preach it,—salesmen talk it,—advertising men write about it. In fact just now it seems to be one of the most-used and perhaps least—understood terms which passes between buyer and seller. It is almost in the same category with the hackneyed word "efficiency." But good service is an essential requisite to a successful business—be it large or small. It is therefore a broad subject—one about which volumes could be and have been written—so a detailed discussion could not possibly be attempted in these columns.

However, there is just one point we wish to bring out. This is that very often the buyer takes for granted that the matter of good service in connection with any business transaction rests entirely with the seller and if the service is not satisfactory, the seller, not the buyer is at fault. An analysis of a number of complaints or comments about service will usually show this is not the case and that the question of good service quite frequently depends upon the acts of both buyer and seller.

We can easily justify these assertions by a consideration of one or two common problems likely to be encountered almost daily in any large business house. Take for example the matter of correspondence. Carelessness in writing letters or orders is closely interlinked with poor service—in fact one is almost the complement of the other. It is really surprising to note how many business letters are improperly written and how many fail to convey the thought their writer wished to expressed. Also how many are incorrectly addressed and therefore, often delayed.

Many persons are in the habit of writing about several different subjects in the same letter. In a large business house such a letter would need to have the attention of several departments. Hence the chance for delay in answering. Again letters are so addressed that it is difficult to tell whether they are personal or business. Such methods may likewise delay prompt replies. To secure prompt attention letters should be addressed to the firm for which they are intended. If, however, the letter is intended for any particular person in the firm, and is business, his name should appear as a sub-address or the letter should be marked for the attention of that individual. Then again if there has been previous correspondence on the subject, reference should be made to it. This is often omitted. Just the day this article was written the writer saw a letter addressed to a large manufacturing concern which read, "Reply to our letter of the 8th." This came from a good sized firm. It is easy to see how such a letter could cause considerable delay in handling the transaction to which it referred and therefore results in what we would probably call "poor service."

So it is with telegrams. Many of them are simply a waste of time and money, because so often they are incomplete or carelessly written. In the desire to hasten matters and save time, the essential details are frequently omitted. This is well illustrated by the following telegram received by the writer some months ago. "Your house advertises overnight shipments. See what you can do with this order. Send me two one-horsepower motors." It is needless to say that this order was not completed without the delay needed to secure more specific requirements from the customer.

Hundreds of similar instances could be easily enumerated by almost any observing person with a few years' business experience, for these are not uncommon but they are sufficient to illustrate the point we wanted to bring out. Similar analysis of many other factors of business will also show that good service depends upon both buyer and seller.

On account of the technical nature of the electrical industry, more care is required to give satisfactory service than in some other fields of business, but the rewards for improvement are also greater.

DIRECTION OF AIR FLOW FROM CEILING FANS

Standard types of ceiling fans have the blades set to throw the air downward but if desired the blades can be arranged to draw the air upward toward the ceiling, that is, the direction of air flow can be reversed. This arrangement permits a general circulation of air without the direct breeze being felt and is convenient in places where papers are to be handled, such as in offices and banks. The upward draft of the fan will ordinarily not be sufficient to disturb the papers. This scheme is also employed to keep flies from gathering on the ceiling.

To make this change it is necessary to use left-hand blade holders or castings. It cannot be done by simply reversing the standard blades and castings. Most manufacturers furnish these special castings without extra charge in place of the regular ones.

It is also possible to secure ceiling fans with adjustable blade features. With this arrangement the position of the blades can be changed at will, so that the air can be directed downward or upward to any degree and by adjusting the blades so they are flat no air will be moved. Fans equipped in this way are par-

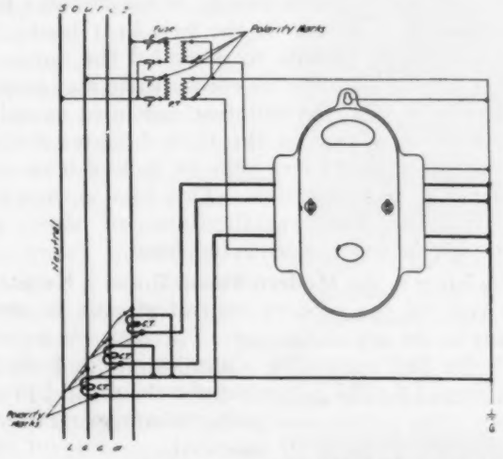
ticularly adaptable for certain installations where good circulation is necessary. As an example, an installation of these fans in a large assembly hall may be arranged so that the air flow can be controlled and so directed as to maintain a constant circulation of air by having the fans in the rear of the hall draw the air upward and those in the front of the hall throw it downward.

Careful consideration of these points will quite often eliminate objections against ceiling fans or help to correct existing installations that are not giving satisfactory results.

NOTES ON WIRING DIAGRAMS

An old custom which is still followed out by many persons is that of indicating the crossing of a wire over another wire in a connection diagram by means of a loop or semi-circle. In the modern diagram this loop is entirely eliminated but dots are placed at the connection points between wires. Carrying out this scheme gives a much neater and more easily read diagram—also one that is more quickly drawn. This is especially so in connection with apparatus involving a large number of wires or when connections between several devices or a complete system are shown. Earlier diagrams drawn along the old ideas were quite complicated.

A modern diagram constructed in accordance with modern practice is shown by the accompanying figure.



Example of Modern Connection Diagram

This diagram is symmetrically drawn and very easily followed. This figure also illustrates another practice which is now being generally adopted by the various manufacturers as new literature is printed—that of including polarity marks for current and potential transformers or other similar devices on all connection prints. These marks on the diagrams correspond to the polarity marks on the transformers which are usually indicated in red color painted on or near one primary and one secondary terminal.

When using some types of alternating current instruments such as wattmeters, power-factor meters and synchroscopes it is essential that they be connected into the circuit with proper regard to the polarity of the transformer terminals. If this is not done, wattmeters may be reversed; or, in case of polyphase wattmeters and power-factor meters, erroneous and misleading indications may be obtained. By comparing the actual marks on the transformers with those on the diagrams the correct connections are easily made. This is an improvement over the old cut and try method of the days when this practice was not in vogue. It will be noted also that the current windings in this diagram are drawn much heavier than the potential circuits to further assist in distinguishing them.

These facts while being of most interest to those doing actual construction work also serve well to indicate how completely the electrical industry, even to the minor details—is being standardized.

STANDARD DIRECTION OF ROTATION FOR ELECTRICAL MACHINERY

The general engineering recommendations of The Electric Power Club include a suggested standard direction of rotation for electrical machinery which is now generally accepted and followed by the manufacturers of such apparatus. Section 5401 in the book of standards issued by the organization under date of February 1, 1917, covers this particular point. It reads as follows: "The standard direction of rotation for all non-reversing direct current motors and single-phase motors shall be counter clock-wise, and for all alternating current and direct current generators shall be clockwise viewed from the end of the machine opposite drive. Unless otherwise specified, standard machines will be connected for standard direction of rotation."

It is always well to check the direction of rotation desired with these standards especially when machines are to be ordered from the factory and built to order. At the factory it is far easier to assemble for a given rotation than on the job and very often by so doing considerable time and expense is saved during erection. Of course the manufacturer cannot be expected to make any changes in apparatus that has been built for stock as this would involve uncrating, re-assembling and retesting in accordance with the standard factory routine which would be quite expensive and undesirable for other reasons.

Alternating current generators and motors of the most common types are easily changed to operate in a different direction of rotation. Generally this requires only changing the collector-ring brush holders and in some cases even this is not done, depending upon the design. With direct current apparatus having a large number of brushes, however, the job is not so easily completed, especially in machines of the commutating-pole type, which are somewhat more difficult to change than the older machines not having these features.

Engine type generators—either direct or alternating current—are always assembled for the correct rotation at the factory, the direction being chosen by agreement with the engine builder.

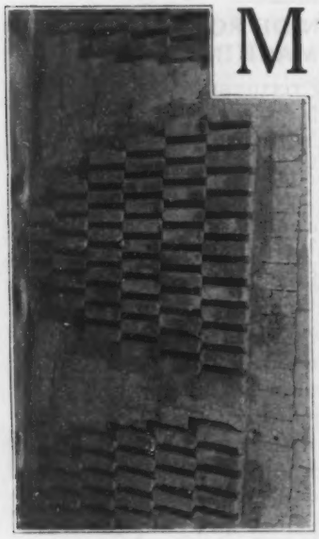
When direct-connected exciters form part of engine-type alternator installations their direction of rotation will be set at the factory. However, when belted-type exciters are to be used the direction of rotation should be considered when ordering as this could not be determined by the factory unless plans of the proposed installation are included with the order. The direction of rotation will depend upon the position of the exciter with reference to the exciter driving pulley on the alternator.

FUEL OIL AND STEAM ENGINEERING

(The "how" and the "why" of steam generation in the boiler when fuel oil is burned beneath it are fundamentals necessary to be understood before intri-cate details in design are considered. In this article the authors first treat of the fundamental principles of the boiler itself and then follow with an elementary discussion of furnace operation. By means of the ground work thus laid, this elementary treatment in later articles is to be broadened out into a discussion of the important points in the design and operation of the modern steam boiler, oil fired.—The Editor.)

THE FUNDAMENTALS OF FURNACE OPERATION IN FUEL OIL PRACTICE

BY ROBERT SIBLEY AND CHAS. H. DELANY



Air Ducts for Furnace Floor

MANY of us are familiar with the famous painting that pictures James Watt as a boy gazing in wide-eyed amazement at the homely tea-kettle spouting forth its hitherto unharnessed power generating vapors. The eyes of the youth are illuminated with that strange and wonderful light that set forth in a measure some of the dreams of constructive imagination which must have been filling his consciousness at that time.

The great inventor of the steam engine undoubtedly saw in the tea-kettle before him, not the homely object of the kitchen, but in its expanded form one of the most necessary mechanisms for modern industrial development—namely, the steam boiler.

Let us then examine the fundamental operation and construction of the steam boiler, and consider this great giant of modern industrial aggrandizement to see wherein it varies from its progenitor—the homely tea-kettle of Watt's boyhood dream.

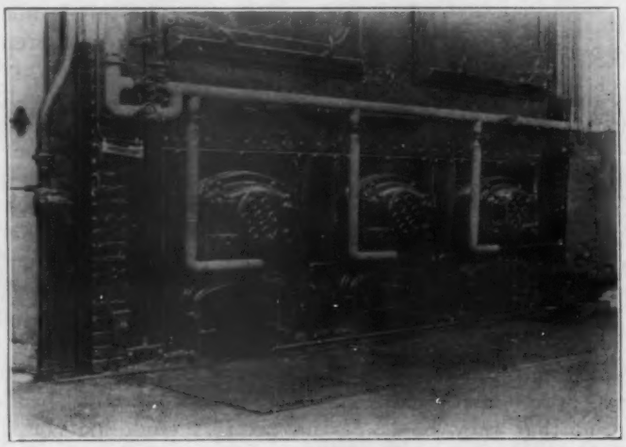
The Fundamentals of the Tea-Kettle and the Boiler are the Same.—The tea-kettle in its construction and operation may be considered under three separate discussions. First, there must be some means of generating and imparting heat; secondly, a container for the water and steam must be constructed with physical characteristics to meet the stresses and strains involved; and, thirdly, the cycle of physical operations through which the water and steam pass in the generation of steam is of vast importance.

The tea-kettle operation in its simplest analysis consists of a flame placed beneath a metal container. This metal container absorbs the heat from the flame and transmits it to the water within the container. When sufficient heat has been absorbed by the water within the container to raise its temperature to the boiling point corresponding to the external pressure of the atmosphere, the tea-kettle boils or in the language of the steam engineer the tea-kettle generates steam.

In its fundamental makeup, the boiler too, quite closely follows this familiar and homely object—the tea-kettle. For in the modern boiler heat is first generated in a furnace. This heat is then imparted to a metallic drum or tubes through which water is passed. When sufficient heat is thus imparted to raise the temperature of the water to the boiling point for the pressure involved, steam generation takes place.

Inefficiency of Tea Kettle Operation.—In modern kitchen economics but little attention is paid to the manner in which the heat is imparted to the tea-kettle. Usually the stove lid is taken off and the kettle placed over the fire space thus created. Some minutes later, the house-wife, ignorant of the vast heat losses that have taken place, returns to draw off the hot water thus inefficiently obtained as convenience may require. As a matter of fact, the slightest and most casual investigation shows that in the United States millions of dollars are wasted every year for lack of reasonable care in the kettle operation. This loss is, however, so widely distributed over thousands of homes that it is not felt in any concentrated form.

Efficiency in the Modern Steam Boiler a Necessity. In the case of the modern central station, however, efficiency is the cry of the day. For with competition on all sides and regulating commissions to limit the prices charged for the power supply, the utmost in economic steam generation is essential.



TYPICAL BOILER FRONT IN FUEL OIL PRACTICE

In this illustration may be seen the fuel oil atomizer in the ash pit entrance, the hooded steam pipes for supplying steam used in atomization, the fuel oil supply pipes, the damper control, the draft gauge and other accessories for fuel oil operation.

Hence, in modern steam boiler operation, especially in its heat generating properties, a wide variation from tea-kettle operation is in vogue, not so much in fundamental principles involved as in efficiency of methods employed in the heat generating mechanisms.

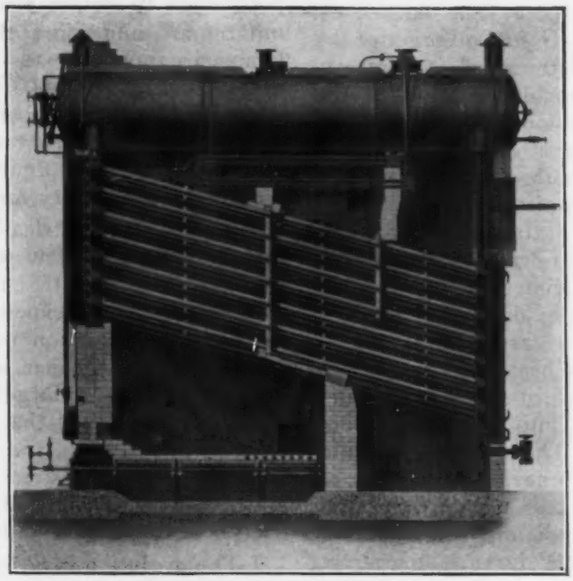
Efficient Furnace Construction of Utmost Importance.—To accomplish this efficiency an enclosed compartment beneath the boiler proper is built. This is known as the furnace. In this furnace heat gener-

ating substances such as coal, wood, and crude petroleum are burned. In the study of chemistry it has been found that certain primary elements, notably carbon, hydrogen, and sulphur, upon coming in contact with heated oxygen undergo a chemical reaction and in doing so give out enormous quantities of heat. It is the generation of this heat and its ultimate absorption by the water in the boiler that makes the modern steam engine and steam turbine the giants in commercial enterprise that today they represent.

Fuels Defined.—In nature, substances such as coal, wood and crude petroleum are found in vast quantities and since these contain large amounts of free carbon and hydrogen, they make excellent articles for heat generation and are called fuels.

An Air Supply Essential.—It has been mentioned that a supply of oxygen is absolutely necessary so that a chemical reaction may take place and thus liberate the heat held in suspense in the fuel. The air about us is made up of about twenty per cent oxygen and eighty per cent nitrogen. The nitrogen is an inert, valueless ingredient that must pass into the furnace, absorb some of its heat and go out through the chimney, thus conducting away into the outer atmosphere some of the heat generated. The oxygen, however, upon coming in contact with the heated carbon, hydrogen, and sulphur of the fuel, readily chemically reacts with them.

Enormous quantities of heat are thus liberated, later to be absorbed by the water of the boiler, eventually to produce the steam delivered for the driving of the steam engine or the steam turbine.



CROSS-SECTIONAL VIEW FOR AN OIL FIRED BOILER

Here may be seen the steam drum, the water tubes, the superheater, the furnace and the atomizer. In this type, which is known as the "back shot," the fuel oil is sprayed from the rear toward the front. The heated gases then travel up around the water tubes and by means of the baffles are forced to zigzag down and up again around the water tubes, finally passing out at the rear of the boiler setting. The air and oil supply are controlled by the operator from the front as shown.

Furnace Operation.—Since this series of articles is largely concerned with fuel oil practice, let us briefly outline the furnace operation for such practice. In a later chapter this will be taken up in more detail.

The Fuel Oil Burner and Its Function.—The fuel oil is sprayed into the furnace by means of an atomizer or burner which pulverizes the oil and delivers it in a gaseous vapor or in small globules at the hottest place in the furnace. Air is admitted from below and as soon as the temperature is raised to the ignition point chemical reaction takes place with the atomized fuel oil, and thus heat is generated. This heat is absorbed by the gases of the furnace and consequently their temperature is at once raised often times to 2300 deg. or 2500 deg. F. These furnace gases consist of the inert nitrogen that partly constituted the entering air, the carbon dioxide or carbon monoxide formed by the burning of the carbon, water vapor formed by the burning of the hydrogen, sulphur dioxide formed by the burning of the sulphur content, which latter ingredient is always small, and a considerable quantity of free oxygen depending on the amount of excess air admitted to the furnace.

The Path of the Furnace Gases.—In their expanded condition, due to the absorption of such huge quantities of heat, the gases now travel upward. As they come in contact with the boiler drums or tubes through which water is circulating, the gases are, of course, cooled and the temperature of the water raised. In this manner the gases, having been chilled or lowered in temperature to 500 deg. or 600 deg. F., are finally passed up through the chimney, and steam generation within the boiler is accomplished.

The Economizer and Its Economic Value.—In some boiler installations a series of tubes through which cold water is passing, are placed between the boiler and the chimney. The chimney gases are thus forced to give up still more of their heat. These outgoing chimney gases are consequently reduced still further in temperature.

Such a device, as cited above, is known as an economizer. This reduction in the temperature of the outgoing chimney gases reduces the draft of the chimney. Hence, the economizer is an economic success so long as the saving in feedwater heating is greater than the interest on the cost of the economizer installation and other apparatus necessary to produce artificial draft, plus the cost of maintenance of this additional apparatus.

Quantity of Air Required—It has been observed that the entrance of air into the furnace is absolutely essential for furnace operations. Too much air, however, is detrimental, for more oxygen may be admitted than can be economically used by the fuel. Hence, too great an excess of air simply means the passage up through the chimney of excess gases which absorb heat only to convey it out into the atmosphere without performing a useful function. In successful boiler operation, therefore, some means must be provided, first to measure the draft; second, to test the ingredients of the outgoing gases; and third, to regulate the entrance of air into the furnace.

The Draft Gage and Its Principle of Operation.—A draft gage usually consists of a column of water placed in a U-tube. The pressure in the chimney is

less than the atmosphere without. Therefore, if one end of this tube is inserted into the chimney and the other rests under the atmospheric pressure without, the difference of water level thus obtained in the U-tube indicates the draft in inches of water. This may be converted into pounds pressure (absolute) per square inch by applying the formulas previously set forth in the chapter on pressures.

Apparatus for Determining Ingredients of Outgoing Chimney Gases.—For economic boiler operation the steam engineer should know the exact composition of the outgoing chimney gases. Since this is a matter of vast importance a later chapter will be given in which detailed discussions of methods involved and apparatus employed will be given. Suffice it to say at this point, however, that by means of such apparatus the engineer may determine whether the fuel is being properly consumed in the furnace and whether too little or too much air is being admitted into the furnace.

Draft Regulating Devices.—In fuel oil practice the proper supply of air may be determined to a nicety. Hence some means must be provided to regulate the air supply with the same precision. This is done by varying the amount of opening of either the ash pit doors or the boiler damper or both. If the air is regulated by partly closing the ash pit doors and leaving the damper wide open a strong draft may occur inside the boiler setting which tends to draw air in through the brick walls. As this is a detriment it is preferable to regulate the air by means of the damper.

The Chimney.—After the gases have passed through and around the various heat absorbing tubes and drums employed in the modern steam boiler and economizer they are shot up into the atmosphere through a long vertical passage. The structure housing this passage is known as a chimney. The height of the chimney and its area of cross-section through which the flue gases pass have an important bearing on the economic boiler or rather furnace operation. This is of such importance that it will be the subject matter for a later discussion.

In a general way, the reader now has a grasp of the fundamentals involved in modern furnace operation for the steam boiler. We shall next consider the container or shell for steam generation and its accessories.

POLES PURCHASED FROM THE FOREST SERVICE

The Forest Service, through its Office of Industrial Investigations, has compiled statistics on the number of poles purchased during 1915 in the United States by the telephone and telegraph companies, steam and electric railroads, and electric light, heat, and power companies. The census was taken exclusively by correspondence with approximately 17,000 purchasers, representing practically all the pole users in the country. About 12,000 concerns returned schedules in reply to either the first or the second request for data.

Table I.—Poles Purchased, by Kind of Wood, 1907 to 1911 and 1915

Kind of Wood.	1915	1911	1910	1909	1908	1907
All kinds	4,077,964	3,418,020	3,870,694	3,738,740	3,249,154	3,283,268
Cedar...	2,521,769	2,100,144	2,431,567	2,439,825	2,200,139	2,109,477
Chestnut.	651,643	693,489	677,517	608,066	516,049	630,282
Pine....	546,233	161,690	184,677	179,586	116,749	155,960
Oak.....	199,442	199,590	263,290	236,842	160,702	76,150
Cypress.	67,644	72,995	75,459	77,677	90,579	100,368
All other	91,233	190,112	236,184	196,744	164,936	210,731

HYDROELECTRIC DEVELOPMENT IN GERMANY

Among the many articles recently written about the utilization of Germany's internal resources, more particularly about the state's share in the promotion of electrical enterprises, is one which appeared in the December 6, 1916, issue of the financial review "Plutus." It is from the pen of Herr Wilhelm Beck, of Steglitz, and gives interesting facts regarding electrical development.

The use of electricity for illumination and power has made remarkable progress during the past three decades. In 1886, statistics show, there were 11,500 arc and 165,000 incandescent lamps in Germany. Today, according to the latest figures, about 4200 power plants are supplying 18,000 communities with electrical current. It is possible for three-quarters of Germany's population to obtain electric power. A quarter of a million arc and more than 25,000,000 incandescent lamps are now in use. The number of stationary motors exceeds 500,000, and they receive a total of about 2,000,000 horsepower. The number of kilowatt hours furnished has increased by 55 per cent in only two years. These figures indicate the general importance of electricity for the German nation.

The oldest electrical plants operated with a continuous current of low tension. Their efficiency was small, and the area that they supplied was limited because of the use of expensive copper conductors. Only since the introduction of a high tension alternating current and a cheaper system of conduction has it been possible to enlarge the area. From the single plant was developed the block station for a residence or other city section, and finally the central station for an entire city. The area was still further enlarged by scale, to local power stations, which in turn will districts and Provinces with electric current.

The evolution is now entering a new stage of centralization. In the future the current will be supplied by long distance power stations, constructed on a large scale of local power stations, which in turn will distribute it to the consumers. Electricity is becoming the common property of all. For many years only the city industries and traffic received the benefits of electrical production. Its utility for the rural districts was not generally perceived. The first step was taken by a few municipal electrical plants which extended the supply of current to the neighboring rural communities. In 1903 several farmers of a district united on a co-operative basis to construct an overland power plant.

It was formerly deemed a principle of political economy that an industry can thrive only where it obtains a large supply of the necessary raw materials—iron, wood, copper ore, earth for brickmaking, etc. Today it is believed that not only such materials are needed but also cheap sources of power for their manufacture. The most valuable of the latter are coal beds, water power, and peat bogs. The last mentioned are very extensive and important in this country. In coal mining Germany holds second place in Europe after England. The water power has been estimated at 1,500,000 h.p. About a quarter of this is already utilized, and large dams and reservoirs are being built.

SPARKS—Current Facts, Figures and Fancy

("Is America to be the railroad builder of the world?" and "What about electrification of railroads throughout the world?" These are some of the notations that are discussed in the following briefs that may serve to sow the seed of usefulness and constructive imagination in your quiet thought. The world is big and the opportunities never more grand than those ahead. Why should you not take a part in these stirring world problems?—The Editor.)

Secretary Lane estimates that there is undeveloped in the United States today something like thirty-five million water horsepower.

* * *

A well-known authority estimates that over a quarter of a billion tons of coal annually could be saved in haulage by developing the waterpowers of the nation to meet its present industrial development.

* * *

Electric-furnace heating has developed low temperature electrothermal processes that are wonders for the art since scientific adjustment and control are possible under this method that can not be approached under any other known procedure.

* * *

Crude petroleum in ever increasing prospects is being unearthed each month in Wyoming. Many thousands of tons of supplies for the oil fields were held up all winter, in Casper by inclement weather and the impassable condition of the roads.

* * *

The campaign for the household electrical proceeds unabated in eastern Washington. In the past five months the Washington Water Power Company has sold and installed four hundred ranges and four hundred water heaters. And the end is not yet.

* * *

Though an enemy army may never land on our shores, there is a powerful enemy already here who annually inflicts upon us damages totaling two hundred million dollars. That enemy is fire. Central stations and hydroelectric companies can do their share in reducing this huge loss.

* * *

Dense Douglas fir, such as is found in butt logs of this tree, which is very abundant on the Pacific Coast, is advocated for "treenails" for ships. "Treenails," or "trunnels," as they are commonly called, are cylindrical wooden pins, used in fastening the parts of wooden ships together.

* * *

For sanitary reasons school slates have not been in favor in many American and English cities for several years, but now that paper has become scarce and expensive there is a movement to return to the use of school slates, with due precautions. Perhaps the hydroelectric industry in the West may soon find an additional outlet of energy for this new industry.

* * *

American exports in May were valued at $551,000,000, a gain of nearly $21,000,000 over April, according to a statement issued by the Bureau of Foreign and Domestic Commerce of the Department of Commerce. The total exports for the 12 months ended with May were valued at nearly $6,183,000,000, the highest figure ever recorded for any one year.

* * *

Producers of crude oil in California declare that the production of petroleum in that state is declining at a very serious rate. Stocks of petroleum were drawn on last year to the extent of fifteen million barrels. It it said that over forty million barrels still remain in storage, which, if the same rate of decrease in production is maintained, will only last for another two years. It is feared that within a year the reserve will be so small that it will be necessary to hold shipments to the amount of production.

* * *

Is America to be the railroad builder for the world? An affirmative answer to this question seems not improbable in view of the reports that American engineers and material will soon be employed in the reconstruction of the transportation systems of Russia and of France, and that after the war it will be to this country that the nations of the globe will look for locomotives, cars, equipment and expert railroad men. And in addition world-wide electrification at American hands must inevitably follow.

* * *

Contracts for two hundred thousand wind-proof shirts at $2.52 each have been awarded by the Navy Department. These garments are part of the special uniform to be furnished American sailors on submarines, submarine chasers, destroyers, and other craft on which the men are greatly exposed. The uniforms were designed by the Bureau of Navigation of the Navy Department, and the contracts call for wind-strapped seams. It would seem that such garments as these might prove useful for employes of hydroelectric companies situated in the high mountains and other exposed places.

* * *

The production of coal in the United States last year, was the greatest in the history of the country. A new record, however, was set for the first six months of this year, fully 270,000,000 tons of bituminous coal being produced since January 1st, thus exceeding the output of the first six months of last year by about 20,000,000 tons. Even better news is that the limit has not yet been reached, for as the railroads are able to work out to better advantage the problem of car supply and give to the mines greater facilities for transporting their product to market, the supply of coal that reaches the consumer will be in steadily increasing quantities.

JOURNAL OF ELECTRICITY

FOUNDED 1887

PUBLISHED SEMI-MONTHLY BY THE

Technical Publishing Company

Crossley Building, San Francisco

E. B. STRONG, President and General Manager
A. H. HALLORAN, V. P. and Managing Editor
ROBERT SIBLEY, Secretary and Editor-in-Chief
E. B. STRONG, Jr., Treasurer
C. L. CORY, Director

ON LIBRARY CARS OF ALL SOUTHERN PACIFIC TRAINS

TERMS OF SUBSCRIPTION

United States, Cuba and Mexico	per year,	$2.50
Dominion of Canada	" "	3.50
Other Foreign Countries within the Postal Union	" "	5.00
Single Copies, Current Month	each	.25

NOTICE TO ADVERTISERS

Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of five days prior to the dates of publication, which are the first and fifteenth of each month. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

Entered as second class matter at the San Francisco Post Office

CONTENTS

A New Advance in Fuel Oil Economy. *By C. D. Stewart.* 49
Costs of Electric Pumping Replacements of Gas Engines. *By Ross B. Mateer* 52
Notes on Public Utility Rates. *By C. E. Grunsky* 53
Night Views. *By C. B. Merrick* 57
Safety Suggestions for Electric Appliances 57
An Electrical Meteorological Station 57
Bearing Currents in a Rotary Converter. *By L. J. Corbett.* 58
Gigantic Electrical Equipment for Cantonments 59
Wireless Telephone Used by Navy in War 59
"Doing-it-Electrically" in the Schools. *By Hoyt Catlin* 60
The Electric Charging Station at Cristobal Terminal 61
Electrification of Swiss Federal Railways 61
The Selection of Heat Insulating Materials *By John Crawford, Jr.* 62
Present Day Engineering Problems in the West. *By J. E. Woodbridge, J. M. Barry, S. J. Lisberger, H. S. Warren, E. R. Northmore, R. E. Cunningham, C. O. Poole, J. E. Macdonald, J. S. Thompson, A. Bowie, D. T. Butts, H. A. Barre, L. M. Klauber, E. A. Quinn, W. J. Davis, P. M. Lincoln, J. A. Koontz, J. A. Lighthipe, P. M. Downing, R. J. C. Wood, S. P. Russell, G. C. Wood, Don Morgan, and J. G. Scrugham* 65
Short Journeys in Pacific Lands 72
Engineering and Commercial Activity on West Coast of Mexico. *By J. W. Finch* 73
Engineering Notes from Peru 73
Electrical Outlook in Japan 73
Recent Rulings and Statutes on Riparian Water Rights. *By A. E. Chandler* 74
Suggestions for Contractor and Dealer. *By George A. Schneider* 76
The Fundamentals of Furnace Operation in Fuel Oil Practice. *By Robert Sibley and Chas. H. Delany* 78
Sparks—Current Facts, Figures and Fancy 81
Editorials 82
Personals 85
Trade Notes 86
New Bulletins 86
Book Review 86
Meeting Notices for Electrical Men 87
Latest in Everything Electrical 90
What Western Inventors are Doing 93
New Electrical Developments 94

TO THE MOTHERS OF ENGINEERS

As a leader in engineering thought of the great West, this Journal would be unmindful of its duty in these days of national stress did it not at this time call the attention of its readers to that patient, long-suffering, soul-inspiring group so dear to us all—the mothers of engineers. And when in the coming months the bravery and daring of a nation, backed by the genius of its engineers, shall gain that heaven of freedom for the democracy of the world, let us, with bowed heads give to the mothers of engineers, whence came so great a portion of the strength for this conflict, the credit where credit is due:

"When the soul of woman conquers
And God's banners are unfurled,
We will gain a glimpse of Heaven
From the hill-tops of the world."

The Coming Conventions

Every indication points to the conclusion that the three coming conventions on the Pacific Coast—The Electrical Supply Jobbers at Del Monte, The Pacific Coast Gas Association at Santa Cruz, and The Northwest Electric Light & Power Association at Spokane—will be unusually well attended and that they will prove helpful to a degree never before realized in the engineering life of the West.

In times of national stress, it is right and proper that this should be true. If ever there was a necessity for co-operation and better mutual understandings and interchange of helpful ideas, this is the time.

Let us all, then, continue to bend every effort toward bringing these meetings to an unprecedented plane of helpfulness and thus aid again in furthering the successful consummation of the world task that is ahead.

Continued Supply of Young Engineers a Necessity

In readusting our mental perspective to meet the enlarged vision of world activity now before the nation, care must be exercised or many essential points for future efficiency are liable to be overlooked.

The demoralization of the status of engineering colleges—both in student and faculty organization—should be most carefully guarded against. While it is of course necessary that the gigantic potentiality of the nation be brought to bear in equipping armies and in provisioning ourselves and our allies, yet only short-sighted preparedness would say that we should overlook our possible status ten years from now.

Educators and engineers should, then, give deep and weighty consideration to the problem of maintain-

ing in our engineering schools the highest and most efficient training possible. And strength of numbers should not be overlooked. A deplorable state of affairs has been found among our allies who overlooked this vital point and today after a brief three years the young and vitalizing force of engineering talent is lacking.

Let us, then, see to it that the splendid technical and engineering laboratories in the universities and colleges of the nation remain filled with younger men in training and that the excellence of instruction be not allowed to depreciate.

The Education Electrical

There is nothing that creates a more lasting impression in the use of electrical energy than that gained by the school child in making for himself or herself some little piece of electrical apparatus that each can call his or her own.

Hundreds of mothers agree that some little hot drink is most beneficial for the child at noon when off at school for the day. To get a wholesome, inexpensive soup has been the long desired goal sought for, but disappointment in price or composition of the soup has been met with in practically every attempt.

On another page of this issue is a description of an electric soup cooker, simple in construction and inexpensive in operation that has been developed in the territory of the Pacific Power & Light Company in the Northwest. It is hard to estimate the educational value of such a device as this. The ingenuity of the child is given a chance to display itself and the usefulness of the article when made, has been tried and found to be of a high degree of excellence.

The education of the young in the method electrical is most important for the future expansion of the utilization of electrical energy. And that education in which the child can take a constructive part is the kind of educative campaign that is the most effective for permanency in results.

Central station managers and commercial agents throughout the West would do well to imitate this excellent campaign in the method electrical that has been so auspiciously inaugurated in the Northwest.

New Construction in California

Activity looking toward further development of electrical energy in California is proceeding on a scale that has not been equaled for years. Although the power companies are doing everything within their control to follow out the ideas put forth by the State Council for Defense looking toward the conservation of fuel, still the saving accomplished is in no way meeting the increased demands for electrical energy.

Some conception of the proportions to which these new plans are daily growing may be gathered from a brief rehearsal of some of the work now under way in California. The Southern California Edison Company has a force of from one thousand to twelve hundred men working at Huntington Lake preparing to install a second unit of the giant Big Creek project. The Sierra & San Francisco Power Company is installing an additional 9000 kw. steam turbine in San Francisco. The San Joaquin Light & Power Company has recently completed a power plant of about six thousand k.w. and contemplates the immediate installation of an additional 15,000 kw. An extended enlargement in the long distance transmission system of the Southern Sierras Power Company is now under way, although this system is already the longest in the world. And finally as a closing citation may be mentioned the work of the Pacific Gas & Electric Company. Not content with its recent installment of 25,000 kw. put in from the Wise & Halsey plants, this company contemplates an additional 5000 kw. at the Spaulding Dam and, upon the Pit River in the north, an additional 150,000 kw. isi being undertaken which will double the output of the company's present eleven hydroelectric plants combined.

Such work as this speaks well for the industrial development of California and means much for permanency in prosperity now felt throughout the confines of this commonwealth. The wheels of industry, set going by means of water power development, will turn forever and neither war nor age can effect the eternal source from which they draw their supply.

False Pride and Patriotism

As these lines go to press the nation is preparing to call to the colors the first five hundred thousand stalwarts that are to be the vanguard of the new vast army which is to assist in spreading the gospel of liberty and democracy throughout the world.

To keep this army in the highest state of efficiency it must be remembered that another vast array of men will be necessary in the industrial channels of the nation.

Much has already been said about getting the wrong man in the wrong place—especially men trained in industrial life that years of preparation have been necessary to bring to a high standard of efficiency.

Attention is especially called at this time to a sense of false pride that is liable to overcome the younger man, which to him may appear not in the light of false pride but in the light of the most loyal patriotism. In a word any young man that is drafted, who is trained to do useful industrial work and especially one who has had years of experience in needful work such as shipbuilding and its allied industries, should make known his fitness for such work.

It is well-known that countless young men stand ready to drop all when the summons come and fly to the colors, even though remarkable experience and training make them better fitted for the needed work they have at hand.

In these times of trial, to be true to yourself and to the nation, the highest patriotism is essential and a candid statement of preparation and experience in necessary industrial activity should not and will not be understood wrongly. Indeed when freed from a false sense of pride, such readiness to serve in any capacity where best to bring to a happy conclusion the

issues at hand, may be classed as the highest and truest patriotism.

Men impelled by such lofty ideals as these are entitled to the same recognition as those who take the field. But whether this recognition be given or not, to be true to the nation, but one course is open.

Oriental Money Standards vs. Engineering Endeavor

Increasing commercial and engineering relations with our Pacific neighbors compel engineers of the West to give consideration to the deplorable conditions of money standards in the Orient.

Since someone has tersely defined an engineer as a person who could create for one dollar material accomplishment that any person could do for two dollars, the question of true engineering must consequently largely interlink itself with the value of a dollar. And when this dollar fluctuates in value from day to day another variable is at once added to complicate engineering computation.

Let us then touch upon some of the leading characteristics of money standards in the Orient. Many of us have heard of the almost universal usage throughout the Orient of the Mexican dollar. Until recently the Mexican dollar was the established legal coin for the Philippine Islands and the Asiatic Coast points.

It is interesting to run back historically for a few moments to satisfy our curiosity as to why Mexico, today rent and riddled with civil strife, with practically no foreign commerce, could ever have exerted such a tremendous influence on Oriental life as to have its coinage system adopted in preference to all others.

The story is quickly told and after it is related, we see once again how the rise and fall of a nation may happen in a few brief years, leaving as earth marks of its former prowess only a skeleton in the embodiment of its money standards.

In the days of the Spanish Armada and the establishment of the Spanish Main, Mexico, teeming with the wealth of the Aztecs, became world famous as the center of civilization in the Western Hemisphere. Her eastern ports became crowded with ships laden with precious metals for the home country and her western ports became the center of activity with Far Eastern or Asiatic trade. The Philippine Islands, the Chinese, and even the Japanese felt the influence of Mexican prowess in the Pacific, and so naturally the Mexican dollar became firmly established as the medium for the interchange of commerce.

Today this last relic of Spanish or Mexican supremacy is fast disappearing from modern use in the Far East.

And well it might, for the confusion resulting from a conflict with the established gold standards of the great nations of the world is hardly in keeping with modern advance in international commerce. Since, nevertheless, this fluctuation or rather conflict of standards is still to be found throughout China and many of the other eastern countries, it is well to be somewhat prepared in order that no undue confusion may result when one is forced to deal with transfers of money from one system to another.

Japan has for some years recognized the necessity of having an established standard of money values which would bring about a fixed ratio of exchange with foreign countries. As a consequence, some years back, she adopted the gold standard with the yen as the principal basis of legal tender. The yen has the value of approximately fifty cents in American money and since one hundred sen make one yen, their smallest coinage notation, the sen is equal to one-half cent in our standard.

Similarly in the Philippine Islands, since the American occupation, money values have been standardized and the Mexican dollar has entirely disappeared from circulation. Interesting tales are told by those who first went to the Philippine Islands immediately after the Americans made their appearance, as to how the shrewd Chinese capitalists who controlled the money markets of these islands, reaped large fortunes when fluctuations occurred with money standards in neighboring countries. No bank notes were in circulation and everyone received their pay in Mexican silver dollars which approximated a value of fifty cents in American money. It was almost necessary to use a wheel-barrow to carry one's savings around. But the surprising thing was the rapidity with which the Chinese bankers could send shiploads of coinage out of the country to the coast of China when any advantage in coinage value was to be gained.

Hence affairs relating to money standards were seen to be so absolutely undependable that a definite readjustment was finally effected which resulted in the Philippine peso, today the legally authorized unit of money denomination.

The peso has an exact ratio of two to one, with the American system of coinage. As a consequence, the peso is equivalent to fifty cents, and the centavo, the one-hundredth part of a peso, has a value of one-half a cent in our money.

Coming now to the Asiatic Coast points, the real confusion begins. In Hong Kong, the great maritime commercial center of the Far East, the Mexican silver dollar there in use has a daily fluctuating value, and if one has money in the bank, it is necessary to read the morning's paper to find how much one is really worth. In normal times the Mexican dollar will vary in value from forty-three cents to fifty cents. During the present international struggle, however, the money markets of the Far East have become so demoralized that recent quotations give the value of Hong Kong and Shanghai money as only worth twenty-one cents to one hundred cents valuation of American money.

In the interior of China, the financial condition or rather the rating of the coinage values is far more demoralizing and subject to even more violent fluctuations from day to day.

In the enlarged activities now before the engineer of the West, the financial intercourse with our foreign neighbors is so closely interwoven with engineering activity itself that the engineer should devote much time and study in giving of his thought and advice to a harmonious solution, looking toward the stabilizing of the Oriental money standard.

PERSONALS

Max Thelen, president of the California Railroad Commission and president of the National Association of Railroad Commissions, as chairman of a committee recently appointed by Governor Stephens in behalf of the State Council for Defense, looking toward the conservation of crude petroleum, has rendered a noteworthy report which has been forwarded to President Wilson for consideration. The report outlines several broad ideals, toward which utility companies using fuel oil as an auxiliary to hydroelectric energy can best co-operate both in their internal balancing of steam and hydroelectric generation and their external relationships the one with the other. But best of all the character of usefulness that such work as this has in store, points to a new departure in commission helpfulness that holds exceedingly bright prospects for utility aid in research and other matters for the future.

Olaf Laurgaard, a consulting engineer of Portland, Ore., has been appointed city engineer of that city, replacing Philip H. Dater.

H. F. Jackson, president and general manager of the Sierra & San Francisco Power Company has returned from a visit to Los Angeles.

Fred Fowler, electrical engineer for the Forest Service is among the student officers at the engineer officers' training quarters at the Presidio.

D. E. Harris, vice-president of the Pacific States Electric Company, has returned to San Francisco from an extended trip through the Northwest.

Chas. F. Gilcrest, superintendent of the meter department of the San Joaquin Light & Power Corporation at Fresno, is a recent San Francisco visitor.

Rudolph W. Van Norden, a consulting engineer of San Francisco, has removed his offices from the Rialto Building to enlarged office facilities at the Alaska Commercial Building.

H. R. Noack, in charge of the hardware and insulator department of the Pacific States Electric Company, headquarters, San Francisco, is looking after business in the Seattle field.

J. W. Simpson, western manager of the Federal Sign System (Electric) expects to leave San Francisco July 17 for Chicago to be gone during the remainder of July and the early part of August.

S. T. Harding, assistant professor of irrigation at the University of California, has returned to Berkeley from several weeks of professional work on soil classification in and about Spokane, Wash.

David T. Mason, professor of forestry at the University of California, has been commissioned a captain in the forestry regiment of the Engineer Corps that is being organized to proceed to France at an early date.

George L. Dillman, a consulting engineer of San Francisco, is distributing an "afterword" to his memorable address on the principle of authority and responsibility which proved so helpful to engineers a year ago.

Elmer Zimmerman, Guy Barker and **George Hagar** are additional contributions of the Pacific Gas & Electric Company's engineering staff in commissioned officers for the United States in its war against Germany.

Raymond Matthew, for the past six months assistant engineer in the offices of Charles H. Lee, consulting engineer, Los Angeles, Cal., has accepted the position of assistant engineer with the Idaho Irrigation Company, Richfield, Idaho.

J. D. Galloway, a consulting engineer of San Francisco, is one of the twenty-four engineers of the United States that is to sit in the Council of the United Engineering Society formed by the four great national engineering societies.

Burton R. Stare, president of the Northwestern Supply Company, dealers in electrical supplies at Seattle, recently returned from a week's outing with his family and a number of friends taken in the vicinity of Whitehorse mountain.

W. B. Greeley, formerly assistant forester at Washington and well known as the organizer of Forest District Number One in the Northwest has been commissioned as major in the forestry regiment of the Engineer Corps that is to proceed to France at an early date.

Harry S. Whiting, president of the Pierson-Roeding Company of San Francisco, and Miss Lucy E. Cormack were married recently at the home of the bride, 1235 Seventh avenue, by Rev. Austin B. Chinn. Miss Cormack is the daughter of C. F. Cormack, manager of the Hasslett Warehouse Company.

Thomas Morrin and **Albert A. Coddington,** consulting mechanical engineers of San Francisco have entered into a partnership under the firm name of Morrin & Coddington. The firm is specially equipped to handle steam power plant design, mechanical equipment of buildngs, water works, valuations and reports.

Major Ralph D. Mershon, Engineer Officers' Reserve Corps, has been relieved from his present duties and will report by letter to the chairman, Naval Consulting Board, at Washington, for duty in connection with military research, retaining station in New York, N. Y. Mr. Mershon is a past president of the American Institute of Electrical Engineers.

Charles N. Black, formerly vice-president and general manager of the United Railroads of San Francisco, and a member of the firm of Ford, Bacon & Davis of New York City, has been made manager of exports for J. P. Morgan & Company, in which capacity he has charge of all purchases for the allies in the United States.

THE NEW JOURNAL SERVICE: The series of articles on rate regulation that has started in this issue under the authorship of C. E. Grunsky, the eminent rate specialist of San Francisco, will be continued for many issues during the coming season. In his discussions Mr. Grunsky will treat of a host of vital points now perplexing engineers and regulating bodies in this important phase of engineering activity. The bonus, the water right value and appreciation factors will all be treated in view of recent court decisions and evolution of the science.

In the issue of the Journal for August 1, 1917, the subject of electric trucks will be treated. A mass of convincing experimental data has been gathered by the largest department store in Portland. This store uses electric trucks of its own design as well as gas operated cars, and it will be shown that in the electric truck of the future the central stations may anticipate a pleasing and profitable load throughout the West.

In recent months great power plants of Arizona have been brought into the limelight as models in efficiency and as representing new advances in power plant design. A beautifully illustrated and most instructive article on the new power plant of the Inspiration Copper Mining Company situated in Arizona, will appear August 15, 1917.

A host of other good things are in the planning.

Captain Richard Park, well-known in San Francisco and vicinity as the active agent in the United States Engineer Corps in organizing the engineer regiments in and about central California has been promoted to the rank of major. This comes as a source of great satisfaction to all in as much as he has been long recognized as a most enthusiastic and able officer in the governmental service.

F. C. Searle, general representative of the sales board of the Allis-Chalmers Manufacturing Company of Milwaukee, is visiting the Pacific coast and making a careful study of the development in the shipbuilding industry. The work at Seattle has come under his observation and in company with **R. T. Stafford,** northwest manager of the Allis-Chalmers Company, he has visited Portland. He will go to San Francisco and Los Angeles before returning home.

C. E. Clark, electrical and illuminating engineer, for Woodill & Hulse Electric Company, Los Angeles, Cal.; **R. J. Downie,** electrician, Union Iron Works, San Francisco; **L. H. Grant,** armature winder and power station operator, Fresno Traction Company, Fresno, Cal.; **S. J. Kennedy,** foreman of construction and maintenance, Great Western Power Company, Oakland, Cal.; **M. Manwaring,** superintendent power plant department, Murray City Corp., Murray, Utah, **H. H. Millar,** inspector in charge, Oakland Bureau, Electrical Testing Laboratories, Oakland, Cal.; **E. M. Ober,** traffic engineer, B. C. Telephone Co., Ltd., Vancouver, B. C.; and **H. J. Smith,** chief draftsman, Sierra & San Francisco Power Company, San Francisco, have been elected associates of the American Institute of Electrical Engineers.

OBITUARY

W. G. Bee, vice-president and past general salesmanager of the Edison Storage Battery Company, died July 11, 1917, at Orange, N. J., after an illness of over a year. Mr. Bee had long been an active figure in the electrical industry and was Mr. Edison's personal friend and assistant in his last visit to the West.

Arthur Gunn, formerly president and general manager of the Wenatchee Valley Gas & Electric Company, whose untimely death was announced in the columns of the Journal

The Late Arthur Gunn

of Electricity June 15, 1917, continues to be the subject of comment among the hydroelectric fraternity throughout the West. At a recent meeting of the executive committee of the Northwest Electric Light & Power Association of which organization Mr. Gunn was the first president, a committee of five was appointed to draft suitable resolutions. On the committee are Norwood W. Buckett and C. J. Edwards of Portland, Oregon; W. T. Wallace of Boise, Idaho; J. F. Roche of Butte, Montana; and J. F. Forquhar of Spokane, Washington.

TRADE NOTES

The Pacific States Electric Company has moved its Seattle offices from 307 First avenue South to 570 First avenue South, where larger and more convenient quarters have been secured.

The Oregon Lumber Company at Baker, Oregon, has placed a contract with the Allis-Chalmers Company for an electrically driven sawmill to cut Oregon pine. This mill is to have a 625 k.v.a. Allis-Chalmers steam turbine unit.

The turbine business on the Pacific coast is exceptionally good with the Allis-Chalmers Company. The Snoqualmie Falls Lumber Company at Snoqualmie Falls, Washington, is installing a 5000 k.v.a. Allis-Chalmers steam turbine unit together with high vacuum Allis-Chalmers jet condenser. It is expected that this plant will be in operation within a short time as all the equipment has been received at the mill.

The Allis-Chalmers Manufacturing Company, having offices at 115 Jackson street, Seattle, recently closed a contract with the city of Seattle for two 4700 k.w. transformers, one 15,000 volts primary and the other 2500 volts secondary at $13,440. They will be direct-connected, two phase and used in connection with the 10,000 k.v.a. steam turbine unit recently purchased from the Allis-Chalmers Company for the steam auxiliary station.

NEW BULLETINS

Occurrence and mitigation of injurious dusts in steel works is discussed in technical paper 153 just issued by the U. S. Bureau of Mines.

The results of physcal tests of roadbuilding rock in 1916, including all compression tests are to be found in bulletin 537 issued from the office of Public Roads and Rural Engineering at Washington, D. C.

Magnetic and other properties of iron-aluminum alloys melted in vacuo are discussed by T. D. Gensen and W. A. Gatward in bulletin 95 of the engineering experiment station of the University of Illinois.

Westinghouse electrical equipment for ventilating service is described in an attractive eighteen page circular 7193.

Hotpoint Tableware, an attractive booklet of thirty-two pages, has just made its appearance to the trade.

BOOK REVIEW

Electrical Measurements in Practice. By F. M. Fariner. Size 6 by 9 in.; 359 pp.; 230 illustrations; cloth binding. Published by McGraw-Hill Book Company and for sale at the Technical Book Shop in San Francisco. Price $4.00.

The subject of electrical measurements has received much attention in the literature of electrical engineering. In general, however, the treatment has been from a theoretical or academic point of view. In this volume the author has endeavored to present the subject in a simple, practical manner and from the standpoint of engineers who are actively engaged in making measurements, tests and investigations in the electrical industry.

The author of this work is chief engineer of the Electrical Testing Laboratories and is well qualified to speak authoritatively on the subject matter he discusses.

A chapter that should prove unusually helpful to engineers in the West at the present time is that devoted to maximum demand measurements. The book is well written, the type and illustrations clear and it is believed that it will prove very useful to all those engaged in the subject of electrical measurements throughout the West.

MEETING NOTICES FOR ELECTRICAL MEN

(The California Association of Electrical Contractors & Dealers in convention assembled at Santa Cruz is at this time holding one of the most helpful and enthusiastic gatherings in the history of the electrical fraternity on the Pacific Coast. The latter part of the month the Pacific Coast Electrical Supply Jobbers are to hold their convention at Del Monte, while in the middle of September Spokane is to be the Mecca toward which eyes of the electrical industry of the West will turn as the Northwest Electric Light & Power Association is to hold its convention at that time. Other news items concerning meetings of interest to electrical men throughout the West are to be found in the following lines.—The Editor.)

The California Association of Electrical Contractors & Dealers

At the time these forms are going to press the assemblage at Santa Cruz of the convention of this organization is beginning to gather. From every quarter enthusiasm is displayed and a remarkable gathering is in swing, full details of which will be published in our next issue.

The Northwest Electric Light & Power Association

At a meeting of the executive committee of this association, called by Mr. O. B. Coldwell, chairman, and held in the offices of the Portland Railway, Light & Power Company, at Portland, on June 29, 1917, the following business was transacted:

Those present were Mr. O. B. Coldwell, chairman; Mr. L. B. Faulkner, Mr. E. G. Robinson, Mr. P. A. Bertrand and Mr. M. C. Osborn.

A. H. Halloran, managing editor of the Journal of Electricity, and secretary of the Pacific Coast Section of the N. E. L. A., of San Francisco; R. M. Townsend, representing the public policy committee of Oregon, and J. C. Martin, chairman of the hydroelectric and technical committee, both of the association, were also present.

Chairman Coldwell announced that the first order of business would be to elect a member to succeed Mr. Arthur Gunn, recently deceased and a member of the committee. Motion was made by Mr. Osborn and seconded by Mr. Faulkner, that Mr. George D. Brown who has been elected to succeed Mr. Gunn as president and general manager of the Wenatchee Valley Gas & Electric Company, at Wenatchee, be elected. Motion carried.

Other important business relative to the dues of company members and relative to the employment of an association man to assist the organization in technical matters were discussed.

Sentiment was strongly evident in favor of a closer relationship with the Pacific Coast Section of N. E. L. A.

Much enthusiasm prevails looking toward a successful outcome of the Spokane convention in September.

The San Francisco Electrical Development & Jovian League

There will be no meetings of the San Francisco Electrical Development & Jovian League during the months of July and August. On September first the League officials are planning to give the activities of the association a gigantic boost for the coming season by holding a smoker, the proceeds of which are to go to the Red Cross.

At the June 27th meeting of the League, a resolution was adopted placing all members who may be called to the service of the United States on the Honor Roll during their term of absence, and the appointment of a committee to maintain correspondence with such honorary members in the field.

In line with the foregoing, W. S. Berry, western sales-manager of the Western Electric Company, W. S. Coleman of the Pacific Gas & Electric Company, and Robert Sibley, editor of the Journal of Electricity, have been appointed by President Alvord of the League.

Among those already on the roll are: Capt. Malone of Northern California Power Co., Captain Baker of Sierra & San Francisco Power Co., and Captain Baldwin and Lieutenant Schloss, both of the General Electric Company.

Portland Section A. I. E. E.

The following officers have been elected by the local sections of the A. I. E. E., Portland, Oregon, for the ensuing year: J. C. Martin, chairman; E. D. Searing, secretary-treasurer; W. D. Scott, R. M. Boykin, board of directors.

The Oregon Society of Engineers

The meeting of the Oregon Society of Engineers for June 25, 1917, was devoted to "City Zoning." The following interesting program was given:

A. G. Clark, presented the plans and objects of the Home Industry League of which he is manager; H. E. Plummer told why the proposed Building Code of the City of Portland contains provisions for limiting the heights of buildings; E. B. McNaughton spoke of "City Zoning and Industrial Development"; Ellis F. Lawrence had for a subject "City Zoning and Planning with special emphasis on the Architectural and Aesthetic Features"; J. J. Sayer gave the views of the Portland Building Owners and Managers Association on "Zoning as Applied to Portland Conditions," and C. Lewis Mead discussed city planning from the viewpoint of the Portland Realty Board.

Exposition of Chemical Industries

An exposition of chemical industries is to be held at the Grand Central Palace in New York City the week of September 24, 1917. Electrical men interested in electro-chemical development are urged to attend.

The Council of the United Engineering Society

On June 27th was held the first meeting of the Engineering Council. This body is a department of the United Engineering Society and has recently come into being as a medium of co-operation between the four national engineering societies. The function of the Council may perhaps best be described by the following extract from the by-laws of the United Engineering Society: "The Council may speak authoritatively

BUILDERS OF THE WEST—IX

HERBERT HOOVER

It is an ever increasing source of gratification to all that the engineers of the West have not only built physical creations in this section of the country that have surpassed in brilliancy and in design the achievements of older and more experienced communities, but that her engineers have gone forth to all the world and accomplished similar feats of engineering. Much might be said of Herbert Hoover, the noted engineer. But to Herbert Hoover, the private citizen, this issue of the Journal is dedicated in appreciation of the countless beautiful expressions concerning him that continue to flow westward from suffering and broken-hearted Europe, which make us all proud to feel that we, too, live and work in the same section of our land that gave strength and power to this mighty builder.

for all member societies on all public questions of a common interest or concern to engineers."

The council is composed of twenty-four members, five being appointed by each of the four founder societies and four by the United Engineering Society.

National Electrical Contractors' Association

The quarterly meeting of the executive committee of the National Electrical Contractors' Association was held in Chicago, June 19th and 20th, at the La Salle Hotel. There was a full attendance at this meeting.

There attended, by invitation, Mr. Wm. L. Goodwin, formerly of California, but now from New York, who is giving much time to the proper organization of industry; Mr. J. M. Wakeman, general manager of the Society for Electrical Development; Mr. E. McCleary, one of the foremost and influential contractors in Detroit, and Mr. Louis Kalischer, local contractor of New York; Mr. Ernest Freeman of the Freeman-Sweet Company, of Chicago, former president of the N. E. C. A., and Mr. Hilton, treasurer of the organization who is from Syracuse.

A resolution was passed with regards to the annual convention to be held in New Orleans, La., October 10th to 13th, inclusive, to the effect that the national stress of affairs justified the officers of the association in making every effort to make this the best and most widely attended convention thus far held.

Illuminating Engineering Society

The election of the following officers of the Council for the fiscal year 1917-1918, was confirmed by the Council on June 14, 1917. These men were elected to fill the offices made vacant by expiration of terms: President, G. H. Stickney; vice-presidents, W. G. Hoyt, C. E. Stephens; general secretary, Clarence L. Law; treasurer, L. B. Marks; directors, R. F. Pierce, S. C. Rogers, P. S. Young.

Code of Ethics of the Oregon Association of Electrical Contractors and Dealers

Section 1. Members of the Association shall regard themselves as being engaged in a business in which there is a well-defined duty and obligation toward the public and themselves. The business demands that members use every honorable means to uphold the dignity and honor of this vocation, to exalt its standards and to extend its spirit of usefulness.

Section 2. Every member of this Association should be mindful of the public welfare and should participate in those movements for public betterment in which his special training and experience qualify him to act. He should not, even under his client's instruction, engage in or encourage any practices contrary to the Rules and Regulations Safeguarding Life and Property, for as he is not obliged to accept a given piece of work, he cannot, by urging that he has followed his client's instruction escape the condemnation attaching to his act. Every member of this association should support all public officials and others who have charge of enforcing safe regulations in the rightful performance of their duty. He should carefully comply with all the laws and regulations touching his vocation, and if any such appear to him unwise or unfair, he should endeavor to have them altered.

Section 3. It is unbusinesslike for a member of this association to assist unqualified persons to evade or to lend himself in the evasion of any of the recognized rules and regulations governing electrical work.

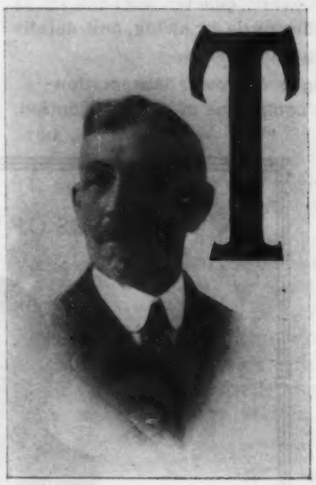
Section 4. Members of this association should expose, without fear or favor, corrupt or dishonest conduct and practices of the members of their business, and it is their duty to bring to the attention of the proper authorities the existence of electrical conditions which are unsafe to life and property.

Section 5. Members of this association owe a duty to the business of refusing to furnish estimates to general contractors who do not regard bids as final and binding upon which they are awarded general contracts.

Section 6. Members of this association shall not falsely or maliciously injure, directly or indirectly, the business reputation, prospects or business of a fellow member of this association.

Section 7. Members of this association shall not attempt to supplant a fellow member after definite steps have been taken toward his employment or toward the letting of a contract to him. Nor should they offer any interference in the carrying out of said contract or commission to the end that loss or damage may result to the fellow member.

Pacific Coast Electrical Supply Jobbers



SAMUEL H. TAYLOR
The staid, conservative figure of Colonel Taylor will be a prominent feature of the convention at Del Monte. The Colonel possesses a rare combination of executive talent and ability to make a visitor feel at ease. Don't fail to give him a chance to welcome you.

THE convention of the Electrical Supply Jobbers' Association at Del Monte July 26, 27 and 28 bids well to be the success of the season. Following closely upon the heels of the contractors' convention at Santa Cruz, which proved such a marked success in every particular this statement needs proof. But there is such a real genuine sincere feeling that pervades the invitations that have gone forth summoning in all those who would be interested in the forthcoming meeting that this in itself bespeaks a goodly assemblage.

In detail this invitation is as follows:

"You are hereby invited to attend the convention of the Electrical Supply Jobbers' Association at the time and place above specified. These conventions have become so standardized that it is perhaps unnecessary to do more than to let you know when and where the meeting will be held.

"There will be the usual golf tournaments, the golf dinner Saturday night, July 28th, with special features, the open session Saturday morning and the other features of the convention.

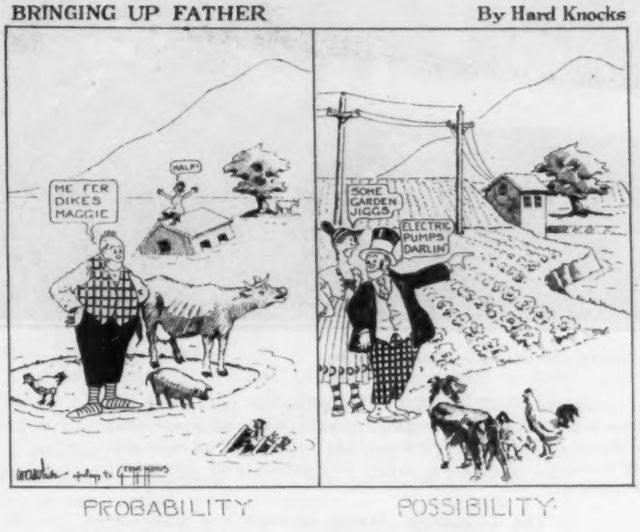
"We are inviting you not as a matter of form, but because we would like to see you with us.

"Come and improve your temper, your golf, your head, your heart and your electrical conscience."

CHARLES WIGGIN

Charlie has come out into the open a little since this picture was taken, but if you really want to see what a persistent study of "alternating—cross-currents or how-I-grow-whiskers" can do for a man don't fail to attend the convention and give Bil Berry the once over,

OF INTEREST TO UTILITY COMPANIES



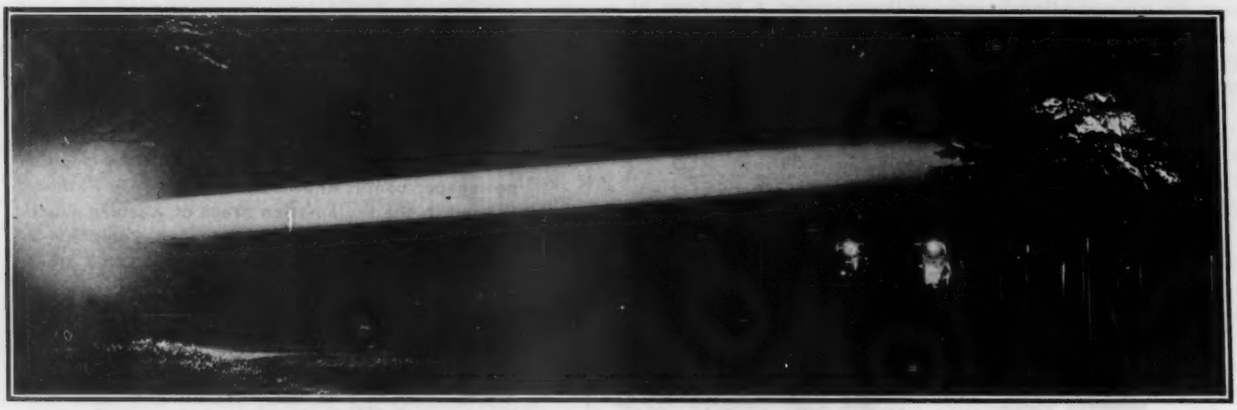
JIGGS AND MAGGIE ASSIST IN ELECTRICAL AGGRANDIZEMENT

Here is a forceful instance of how the popular newspaper comic, known as "Bringing Up Father," is used in the reclamation areas of western Washington by the North Coast Power Company to promote the use of electrical energy in this profitable field of electrical application. An important psychological principle is here made use of that other utilities of the West may well bear in mind in putting out similar publicity matter. The combination of a widely known comic idea with the home building incentive has such an agreeable tingue to it that the reader's attention is focused at once and the point of electrical aggrandizement driven home so unconsciously that the reader is taken unawares and the idea fixed firmly in mind.

THE UTILITY AND NATIONAL SERVICE

Never before in the history of the electrical industry has the public generally been forced to admit the wonderful possibilities of service by the hydroelectric companies of the West apart from the vending of electricity than has come to the public conscience in the past thirty days. The great Liberty Loan, the Red Cross, and a thousand other aids have been rendered of incalculable benefit to the nation. Here is how the Pacific Power & Light Company has contributed most effectively in boosting the recruting campaign in the Northwest for the U. S. Marine Corps.

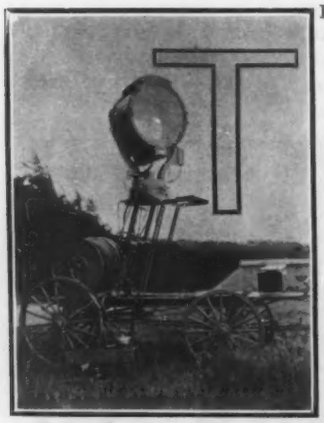
LATEST IN EVERYTHING ELECTRICAL



The Electric Arc and Its Use in the Modern Field Service

(Electricity is playing the leading role in the present world conflict. Engineers of the West are fast filling needed positions to revitalize the armies and navies of the allied forces both at home and abroad. Below will be found notations on additional calls that are being made for electrical men and officers for the engineer regiments that are being formed. Notes on other interesting and important advances in the electrical industry follow.—The Editor.)

ELECTRICITY IN THE ARMY



A Portable Electric Arc in the U. S. Army Service

THE applications of electricity in modern warfare are practically without limit. All men of the electrical industry are called upon to give particular attention to the following classes of men needed in the mobilization of the nation's engineering strength.

Men skilled in civil engineering and similar occupations are wanted in the Engineer Enlisted Reserve Corps of the United States Army for war service. Skilled laborers, mechanics and artisans, miners, surveyors, draftsmen, lithographers, boatmen, electricians, and others engaged in engineering or mechanical lines in civil life are wanted for enlistment in the Engineer Enlisted Reserve Corps of U. S. Army. The War Department desires to secure immediately a large enrollment of enlisted men in this Corps, and suitable men are urged to make application either by mail or in person to one of the following offices:

District Engineer Officer, 204 Pine Street, San Francisco, Cal.
District Engineer Officer, 723 Central Bldg., Los Angeles, Cal.
District Engineer Officer, 602 Burke Building, Seattle, Wash.
District Engineer Officer, First District, 806 Couch Building, Portland, Ore.
District Engineer Officer, Second District, 321 Custom House, Portland, Ore.
District Engineer Office, Third District, 405 Customs House, San Francisco, Cal.
District Engineer Field Office, Eureka, Cal.
District Engineer Field Office, Fort Rosecrans, Cal.

All members of the National Engineer Societies and all other civilian engineers or other civilians engaged in engineer construction or contract work, electrical engineering, mining and allied professions, are appealed to to induce high class skilled men to join the enlisted reserve corps of engineers.

The following classes of men are wanted:

a. Topographical surveyors and sketchers, including good instrument men.
b. Draftsmen, topographical and mechanical.
c. Photographers and blueprint men.
d. Lithographers and zincographers.
e. Quarrymen (skilled in explosives).
f. Miners.
g. Skilled carpenters.
h. Bridge carpenters.
i. Blacksmiths.
j. Plumbers and pipefitters.
k. Electricians.
l. Enginemen, steam.
m. Enginemen, gas.
n. Firemen.
o. Machinists.
p. Masons.
q. Caulkers.
r. Riggers.
s. Expert axemen.
t. Boatmen
u. Horseshoers.
v. Farriers.
w. Packers.
x. Teamsters.
y. Saddlers.
z. Cooks.
aa. Assistant cooks.
bb. Clerks.
cc. Musicians.
dd. Signalmen, as required by Army Regulations.

An Engineer Company is composed of 109 engineer soldiers, graded as follows:

3	Sergeants, 1st Class.
1	Supply Sergeant
12	Corporals.
2	Cooks.
59	Privates.
1	First Sergeant.
1	Stable Sergeant.
1	Horseshoer.
2	Buglers.
1	Mess Sergeant.
6	Sergeants.
1	Saddler.
19	Privates, 1st Class.
109	Total.

Sergeants must be at least 30 years old and have sufficient education to perform the duties of the grade and must hold in civil life, a position equal to, or of the same importance as foreman in the Engineer Department of the Army, and shall be expert in one or more of the special qualifications listed in sub-paragraph 1 above.

Corporals must be at least 25 years of age and must hold in civil life, a position equal to, or of the same importance as foremen in the Engineer Department of the Army, and shall be expert in one or more of the special qualifications listed in sub-paragrtph 1 above.

Privates, 1st class, and privates, must have one or more of qualifications listed above.

The rates of pay are as follows:

Master Engineer, senior grade	$75	Mess Sergeant	$36
Master Engineer, junior grade	65	Supply Sergeant	36
Regimental Sergeant, Major	45	Stable Sergeant	36
Battalion Sergeant Major	45	Sergeant, 1st Class	45
Regimental Supply Sergeant	45	Sergeant	36
Battalion Supply Sergeant	45	Corporal	24
		Cook	30
		Bugler	15
		Horseshoer	30
		Saddler	21

Color Sergeant	36	Wagoner	21
Sergeant Bugler	40	Private, 1st Class	18
First Sergeant	45	Private	15

Further information of the details of enlistment will be sent upon request made to any district engineer officer or to any of the reserve corps officers listed above.

All enlistments are desired for war service and none will be accepted for less than the period of the war. "All subsistence, equipment, uniforms and transportation are furnished by the government."

The Engineer Corps in our army corresponds to the famous Royal Engineers of the British army, who have constructed the marvelous system of field fortifications that have for nearly 3 years sheltered the English armies in France and enable them to withstand the onslaught of the Germans.

Second, Officers' Training Camp, The Presidio, San Francisco

To provide officers for the drafted forces of the National Army the War Department has adopted the policy of commissioning all new officers of the line (Infantry, Cavalry, Field and Coast Artillery) purely on the basis of demonstrated ability after three months' observation and training in the Officers' Training Camps.

A second series of officers' training camps will be held beginning August 27, 1917, with the definite mission of producing a body of line officers (Infantry, Cavalry, Field and Coast Artillery) capable of filling all places in the grades above lieutenant and many of the places in the grade of lieutenant in the second 500,000 troops.

The second Camp for the Western Department will be held at the Presidio Reservation, San Francisco, Cal., and will open on August 27, 1917, and close November 26, 1917.

Every candidate must file his application in person with the local committee of the Military Training Camps Association in the town in which he resides. A Military Training Camps Association Committee will be appointed in every town having a population of not less than 2500 within the eight states from which candidates are to be drawn for the Presidio Camp. From these committees application blanks can be secured. Information as to the identity and address of the above mentioned local committees can be had from the cashier of any bank. Do not mail your application.

The headquarters of the Military Training Camps Association for the Western Department can be addressed as below.

P. M. LANSDALE, Executive Secretary,
Military Training Camps Association of the United States,
Western Department, 201 Pine St., San Francisco, Cal.

"MORE THAN 3000 USES FOR ELECTRICITY"

That electricity is invading every line of human endeavor is well known, but that there are more than 3000 applications of electric current in 109 trades and industries has hardly been appreciated. The Society for Electrical Development, after an exhaustive research, has just issued a booklet listing these applications. It has been sent free to all members of the society.

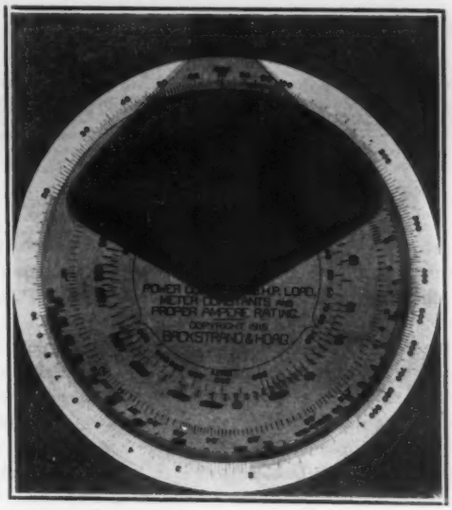
A LIVE CAMPAIGN FOR THE METHOD ELECTRICAL

Fred C. Todt in a remarkably forceful contribution to the news bulletin of the Pacific States Electric Company has thus summarized the effective work of the Hurley organization in abolishing the drudgery of the household by means of the method electrical:

"In summing up the situation on the Portland Front we report with much confidence that the drive against washday drudgery will net many new positions to our arms and ultimately result in reducing the number of positions held by washday drudgery to a number so small that their existence will be difficult to locate and will cause us but little concern"

A NOVEL CALCULATING DEVICE

A Novel Calculating Device has recently been perfected by C. M. Hoag and C. F. Backstrand of Riverside, California. The device is constructed on the principle of the circular slide rule with scales arranged for determining metered loads directly, without the use of a meter formula. Salesmen for machinery and power concerns have found that this calculator has filled a long felt need of a device that may be used

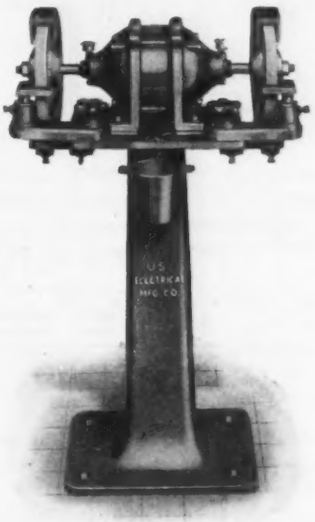


A New Rapid Calculator

by a person not familiar with meter formulas. The following results may be read directly with a setting on the calculator: Horsepower and kilowatt load, power cost in dollars per hour and necessary ampere rating for meters at any voltage or load. It is adapted for use with Westinghouse, General Electric or Ft. Wayne meters, and the device may also be used as a slide rule for other calculations. The price of this calculator together with a substantial leather case is $1.50. On sale at the Technical Book Shop, 618 Mission street, San Francisco.

NEW ELECTRICALLY DRIVEN EMERY WHEELS

The new compact design of electrically driven apparatus is set forth in the illustration shown herewith in which

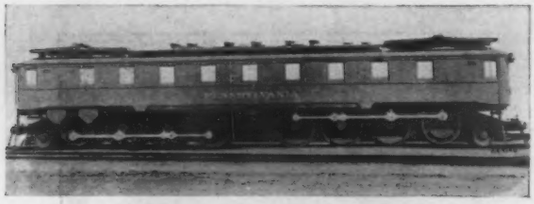


A Recent Advance in Shop Equipment

the motor forms the central portion of the drive. These designs are by the U. S. Electrical Manufacturing Company of Los Angeles.

THE MOST POWERFUL LOCOMOTIVE IN THE WORLD

One more forward step has been taken by an important American railroad in an endeavor to improve traffic conditions by increasing the efficiency of its present track equipment. Such a step is the recent construction of the most powerful electric locomotive ever built, a joint design of the Pennsylvania Railroad Company and the Westinghouse Electric &



The Largest Electric Locomotive in the World

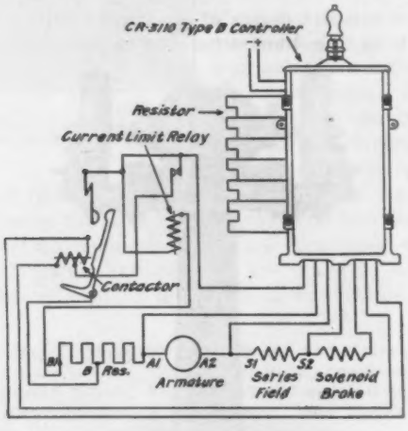
Manufacturing Company. The mechanical parts were erected at the Juniata shops of the railroad company at Altoona, Pa., and the electrical equipment built at the East Pittsburgh shops of the Westinghouse Company.

This locomotive, capable of exerting 7000 horsepower, or more than any locomotive ever built, is the first of what will be a standard type of high powered electric freight engines of the Pennsylvania railroad, and by them is designated as Class FFI. It is interesting to note that the design of this monster is simply another advance in railroad practice by this railroad, thus following a program exemplified by the building of the first steel passenger car.

NEW SEMI-MAGNETIC DYNAMIC BRAKING CONTROL FOR CRANE HOIST SERVICE

The General Electric Company has recently brought out an automatic device which can be added to their standard Type B drum controller and thus make a very serviceable semi-magnetic dynamic braking control for crane hoist service.

A dynamic braking, manually operated, drum type controller is more severe on the commutator of a direct current series motor than is a plain reversing manual controller, because, when lowering, the motor is connected similar to a



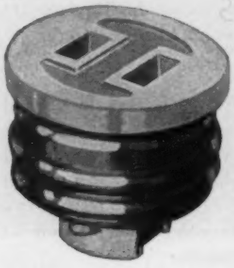
Connections for Crane Hoist Service

shunt wound motor and does not have the inherent protection of the series field. In many installations, where the service is severe, a semi-magnetic equipment will materially assist commutation. This equipment is useful also where the service is not quite severe enough to justify the expense of a full magnetic equipment.

This device protects the commutator from severe arcing. It protects the controller fingers and segments from severe burning. It enables the motor to run at a higher lowering speed for a given severity and condition of service, provided extra resistors are used to weaken the motor field.

SPARTAN PLUG ADAPTER FOR SCREW BASE RECEPTACLE

The majority of current consuming devices sold and used today have extension cords with separable attachment plugs of the standardized type. To make it possible to use these devices where base board receptacles are of the Edison or screw type, The Bryant Electric Company, of Bridgeport,



An Improved Plug Adapter

Conn, has designed the Spartan Screw Base Adapter shown herewith.

This device is made to be fastened into the standard Edison receptacle by means of the threaded part and will serve to permanently convert the old type receptable into a "Spartan" device.

A NEW RECORDING-DEMAND WATTHOUR METER

The entire meter is mounted on a cast iron base. The cover is of pressed zinc with dead black finish and is fitted with a dust-proof gasket. The glass windows over the dial and chart are well sealed. The electrical measuring element consists of the standard Westinghouse type OA watthour meter on its own supporting casting but without cover.

The Type R-A Recording Demand Meter

Therefore, this element can be removed from the case as a unit without changing the calibration.

The paper driving mechanism is a metal drum with pins that engage in performations in the record paper, driven through gearing by the operating spring. The paper, which is furnished in 18 foot rolls (thirty-six days supply), is held on a spindle and is wound off this onto a drum by the driving mechanism.

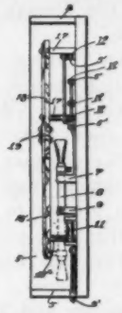
The Type RA Recording-Demand watthour meter is made by the Westinghouse Electric and Manufacturing Company.

WHAT WESTERN INVENTORS ARE DOING

(Automatic train-stops have long been under the careful surveiliance of inventors. Below is a brief describing a recent invention along this line perfected by a California investigator in which a pneumatic motor is made use of and an ingenious connection with a storage reservoir effected. Other inventions consisting of a safety means for switch boxes, an aeroplane, and a rotary engine are also briefed. The notation on an insect-killer may also be found useful in construction camps throughout the West where insects often prove a nuisance.—The Editor.)

1,228,839. **Safety Means for Switch-Boxes.** Lester Siebenhauer, San Francisco, Cal., assignor to Drendell Electrical & Manufacturing Company, San Francisco, Cal., a corporation of California.

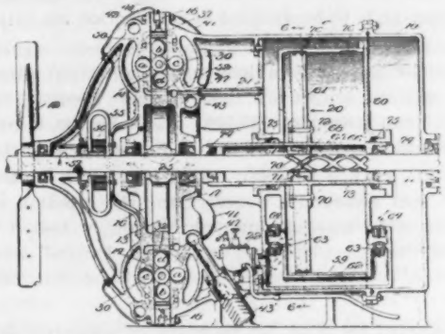
A switch-box the combination of a base, side walls surrounding the same and projecting above the face thereof, exposed bus bars carried on the face of the base, laterals extending from the bus bars, an insulated switch for controlling



each set of laterals, a knife switch associated with the bus bars and controlling the supply of current thereto, and a protecting plate of insulating material supported above bus bars and knife switch for protecting the same against accidental contact therewith, the portion over the knife switch being hinged to that portion over the bus bars and capable of raising to permit the operation of the switch, said hinged portion adapted for overlying the switch when the same is either in open or closed position.

1,229,519. **Rotary Engine.** Alvah Jewel Howd, Nampa, Idaho, assignor of seventy one-hundredths to Edward H. Dewey, and five one-hundredths to Laura E. McDermott, Nampa, Idaho.

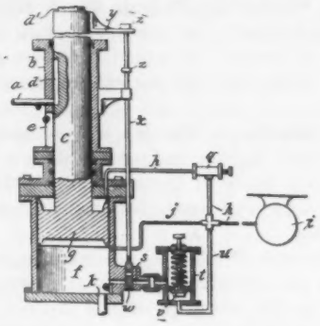
A rotary engine, in combination, a casing having a plurality of separated cylinders formed in opposite walls thereof,



a rotor turning therebetween, and revoluble pistons carried by the rotor successively engaging the cylinders, the pistons being mounted on fixed axes lying in the plane of the rotor.

1,229,151. **Automatic Train-Stop.** Hiram Gee Sedgwick, Mill Valley, Cal., assignor to The National Safety Appliance Company, a corporation of California.

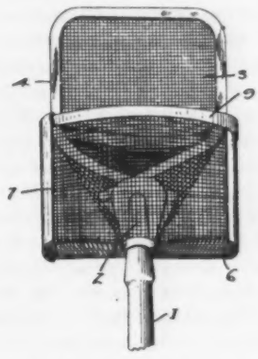
An automatic train stop, a brake controlling means on the locomotive, a pneumatic motor for operating the same and means for connecting the motor to a storage reservoir, means for governing the supply to the motor to cause the same to operate and apply the brakes, means for restoring the motor



to operative position, these means embodying a cut off automatically opened and closed by the action of the motor.

1,228,701. **Insect-Killer.** Alexander E. Rochfort, Oakland, Cal.

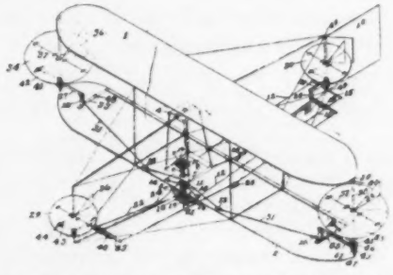
The combination with a handle, a flexible insect killer fixed in the handle and alined with the handle; and a retaining



means attached to the handle and spaced therefrom and surrounding part of the killer.

1,228,705. **Aeroplane.** Osam Shudow, San Francisco, Cal.

An aeroplane balancing control, the combination of a frame, an operator's swing seat attached to the frame, and a manually controlled lever mounted on the frame so as to



move relative to the frame, and movably jointed to the seat, whereby the lever moves relative to the seat and frame as the former swings relative to the latter.

NEW ELECTRICAL DEVELOPMENTS

(An interesting and significant item in new electrical development during the past semi-monthly period is the judgment of $51.50 that has been awarded for the $50,000 damage suit against the Pacific Gas & Electric Co. at Oroville. The case demonstrates the fact that the general public will no longer tolerate an unreasonable valuation on property that is necessary in the development of its publicly regulated utility organizations. Other items of interest in electrical development throughout the West follow.—The Editor.)

FINANCIAL

BOVILL, IDAHO.—At a special election last week the $5500 bond issue to install an electric light plant, carried.

PHOENIX, ARIZ.—The Phoenix Gas & Electric Company has been given authority by the corporation commission to issue $555,000 in bonds, of which $185,000 are to be debenture bonds. The bonds are for extensions and general improvements.

SAFFORD, ARIZ.—An election will be held at Thatcher on the 30th of July for the purpose of determining whether the bonds of said town to the amount of $18,000 shall be issued for the purpose of establishing and operating an electric lighting plant.

PORT ANGELES, WASH.—An ordinance providing for a special election to authorize the issue of $30,000 worth of bonds secured by the revenue of the electric light department, has been introduced and put through preliminary stages. The money is to be used to retire outstanding warrants and to provide for extensions and betterments of the lighting system of the city.

SANTA FE, N. M.—The Rio Grande Light, Heat & Power Company has filed in the office of the Bernalilo County Clerk at Albuquerque, a deed of trust for $3,000,000 pledging its franchise and properties, including the dam, power plant and transmission lines which are to be constructed, to the Fairmount Savings Trust Company of Philadelphia. This action is for bonding the White Rock Canyon project.

OROVILLE, CAL.—A judgment for $51.50 when the defendant had asked $50,000 damages was the verdict returned in the condemnation suit of the Pacific Gas & Electric Company against Henry W. Taylor of the Butte Creek district. The power company sought to gain possession of a small piece of Taylor's land on Butte Creek as a dam site. The company already has a wooden dam on Taylor's property and wanted to construct a concrete dam near the old one.

SAN FRANCISCO, CAL.—Creditors of the Gas & Electric Appliance Company have filed an involuntary petition in bankruptcy against the concern in the Federal District Court. The petitioning creditors are the Holbrook, Merrill & Stetson Company, M. Straulsaft Company and John A. Roeblings' Sons Company. It is charged that the company owes debts in excess of $10,000. The creditors obtained an order to show cause, and a restraining order preventing sale of the company's assets to satisfy a judgment of $17,969.59 obtained against it by C. W. Strawbridge.

TRANSMISSION

MURPHYS, CAL.—The Burnsted mine will soon be equipped with an electrical hoist and work will be begun at once.

CROCKETT, CAL.—Work has been started on the new power station of the Great Western Power Company on the hills in the Bay Addition to Crockett.

OAKLAND, CAL.—Permits have been taken out by the Pacific Pipe & Tank Company for the construction of a sawmill, dry kiln, power house, etc., in Oakland, to cost about $12,000.

LOS ANGELES, CAL.—Sealed bids will be received by the board of public service commissioners for copper cables and wires in accordance with specifications on file in the office of the board.

COLVILLE, WASH.—The Stevens County Light & Power Company has petitioned the County Commissioners for a franchise to erect and operate electric transmission lines over certain roads in the county.

EUGENE, ORE.—The Comet Electric Company at Eugene has been awarded the contract for electrical work in connection with the erection of the Woman's Dormitory at the University of Oregon, Eugene.

VENTURA, CAL.—The Ventura Light & Power Company is constructing a distributing system at Semis, which will insure first class service both for light and power purposes. The new system will cost about $4000.

RIVERSIDE, CAL.—The contract for the erection of electric transmission and telephone lines in connection with the Paradise Valley irrigation project in Butte County has been awarded to the City Electric Supply Company of Riverside.

TONOPAH, NEV.—Work has begun on the largest auxiliary power station in Nye County. The plant is to be constructed for the Great Western and Tonopah Bonanza mines, and will furnish power for operating all the machinery of those mines.

EVERETT, WASH.—The Commissioners of Snohomish County have granted the Everett Gas Company permission to erect and operate electric transmission lines over certain roads in the county in the vicinity of Snohomish for a period of 50 years.

BEVERLY HILLS, CAL.—The State Railroad Commission has granted the Beverly Hills Utilities Company, which furnishes electrical service in and about Beverly Hills, permission to sell its system to the Southern California Edison Company of Los Angeles, at about $23,347.

YUMA, ARIZ.—An application has been filed with the city council asking for a franchise and right of way for a line of poles, wires and other conduits and conveyances for electrical energy along Gila street, by E. F. Sanguinetti and F. L. Ewing. The matter is to be decided at an election on July 19th.

HARLEM, MONT.—A company has been organized by local business men to establish an electric light plant. The company will be known as the Citizens' Electric Company and will be capitalized at $25,000. R. G. Barton is president, J. M. Rantschler is secretary, and H. C. Anderson is treasurer.

FRESNO, CAL.—The San Joaquin Light & Power Company has been awarded a contract for the erection of a 250 h.p. reciprocating booster pumping station in the vicinity of Taft, Kern County. The station will be located about midway between Taft and Buena Vista Lake and will cost about $50,000.

LOS ANGELES, CAL.—The board of education is receiving sealed bids at the office of the secretary of the board for the installation of all electrical work (electric switchboard and feeders) in the boiler house and ground of the new Los Angeles High School, at the Country Club Drive and Rimpau Avenue.

SAN DIEGO, CAL.—Two hundred and thirty-two acres of tide lands abutting on the Point Loma boulevard and 500 acres of tide lands in Dutch flats were turned over to the navy department to be used as a site for the marine brigade

post; $600,000 is available for installation of sewage, water and lighting systems for the brigade post.

BOISE, IDAHO.—Extensive improvements are contemplated to the Swan Falls plant of the Idaho Power Company during the summer, involving an expenditure of more than $500,000 and increasing the output by 8000 h.p. The company will also begin work this summer on the erection of an electric transmission line into the Jarbridge district.

GRANGEVILLE, IDAHO.—Plans are being made by the Grangeville Electric Light & Power Company for the construction of a dam and flume and power plant, to cost about $75,000. The new dam will be built below the present dam, which is near Grangeville, and will develop from 1500 to 2000 h.p. The new flume will be 1500 ft. in length and will replace a flume 4000 ft. long. Eugene Enloe is president.

YOSEMITE, CAL.—Word has been received that Congress has appropriated $253,000, the full amount asked by the Department of the Interior, for Yosemite National Park. This will provide sufficient funds to complete the new power plant this fall and continue the building of the new roadway connecting El Portal with the park. The power plant will have an output of 2000 kw.

PALMDALE, CAL.—Sales Manager G. B. McLean of the Southern California Edison Company, Los Angeles, states that electric energy for light and power will be available in Palmdale and the surrounding territory in the next 40 days. Actual construction of the work will begin at once. The power company will extend its wires from Lancaster along the section boundaries one mile east of the Southern Pacific tracks into Palmdale and thence east to Littlerock with laterals sufficient to care for the various pumping plants in this end of the valley.

WENGLER, CAL.—The Pacific Gas & Electric Company is employing 108 men in its two camps in the Big Bend of the Pit. Just now the most important work is to strengthen the culverts so the five heavy auto trucks may haul in great loads of supplies and material. Two electric locomotives have been delivered. They will be used in hauling earth from the two header tunnels. An auxiliary power plant will be built in the Cove. It will have ample capacity to furnish all the power needed in construction work. The camp at Cove is growing slowly and a few families have arrived. Included among them is the family of C. Cogan, the superintendent.

ILLUMINATION

RENO, NEV.—Brown & Shearer have started an electric shop in this city.

LODI, CAL.—Efforts are being made to install electroliers on all streets here.

OSWEGO, MONT.—The local electric light plant is reported to have been destroyed recently by a tornado.

RIVERSIDE CAL.—The board of supervisors has voted to advertise for bids on new electric wiring in the court house.

LOS ANGELES, CAL.—The hearing on a petition for the formation of the Annandale Lighting District has been set by the board of supervisors for July 16th.

SAN JOSE, CAL.—San Jose is to have a new system of street lighting. The old magnetite lamps are to be supplanted by 120 new Mazda lamps of 250 candlepower.

PORTLAND, ORE.—Bids are being received by E. L. Coburn, county clerk, Josephine County, Oregon, for the electrical fixtures for the new court house at Grants Pass, Ore.

RICHMOND, CAL.—Steps have been taken by the lighting committee for the installation of an electrolier lighting system on McDonald avenue, from First to Twenty-third avenue.

JEROME, ARIZ.—Cottonwood is soon to have an electric light and power service according to M. A. Farnsworth of the Arizona Power Company. The line will be built as soon as possible.

SAN DIEGO, CAL.—Congress has appropriated the sum of $600,000 for the installation of an electric-lighting system and other improvements on a site to be used for a marine brigade post.

EVERETT, WASH.—Bids will be received by Mae Weatherbee, County Auditor of Snohomish County, Everett, Wash., until July 16, 1917, for electrical work in the tuberculosis sanitarium.

LOS ANGELES, CAL.—Plans have been announced by the Los Angeles Investment Company for the construction of a number of colonial bungalows in Rodgers Park. A new street lighting system is also included in the new project.

REDWOOD CITY, CAL.—The Pacific Gas & Electric Company will shortly award a contract for the construction of a modern one-story class C office building which is to be erected on property in the business center of Redwood City.

ALAMEDA, CAL.—Work of installing electroliers along Webster street will begin in the near future. The wiring for the new system will be underground. The standards will be of 3-lamp design.

WILLIAMS, ARIZ.—The power house of the Williams Water & Electric Company was burned recently. Williams will be without electric lights and power until arrangements can be made to use the current from the mill. The loss is roughly estimated at $100,000.

OAKLAND, CAL.—Sealed bids are being received by the board of library directors for furnishing material and labor for installing electric work in the construction of a two-story building to be known as the 23d Avenue branch of the Oakland Free Library, at the corner of East 15th and Foothill boulevard.

LOS ANGELES, CAL.—Plans are being made by the Hill Street Improvement Association for an ornamental lighting system which will follow along the lines proposed for the Broadway scheme. The advisory board of the association will meet later in the week to appoint a by-laws committee and to commence active operations.

SAN BERNARDINO, CAL.—This city is to be the district headquarters of the Southern California Edison Company, which recently absorbed the Pacific Light & Power Corporation, and the company will establish big offices at some point in the business district, not yet selected. It is probable that a building will be erected of which the company would lease a large portion.

COLVILLE, WASH.—The Stephens County Power & Light Company, a corporation, has petitioned the board of county commissioners of Stevens County, Washington, for a franchise to construct and operate a line of poles, with lines and cables to be strung thereon, with the transmission of electricity and electric energy for light along the following county roads. The Cottonwood road, the E. E. Burr road, the Stensgar road, the La Pray bridge road.

TRANSPORTATION

FULLERTON, CAL.—Construction on the Pacific Electric line into this city will start from this end at once.

SALT LAKE CITY, UTAH.—Work will start soon on equipping the Saltair, Garfield & Western Railroad for electrical operation.

LOS ANGELES, CAL.—The Pacific Electric Railway will extend its tracks to take care of any traffic problems due to the military camp being here.

SEATTLE, WASH.—The city council is planning to build the municipal car line to the Todd shipbuilding plant by August 15, providing that equipment can be secured.

SAN DIEGO, CAL.—An ordinance has been adopted by the common council granting the San Diego Electric Railway company a franchise to construct and operate a street railway upon certain streets in the city of San Diego.

SACRAMENTO, CAL.—John P. Coghlan, receiver for the Northern Electric Railroad Company, was in Sacramento and while here signed the contract for the construction of the freight wharf and shed which the company is to erect at West Sacramento. E. W. Book was awarded the contract.

TELEPHONE AND TELEGRAPH

WATSONVILLE, CAL.—The Pacific Telephone & Telegraph Company has applied for a franchise in this city.

TROY, IDAHO.—The Troy Rural Telephone Company has changed its name to the Troy Telephone & Electric Company.

FOWLER, CAL.—John Magill has been appointed assistant superintendent of line construction of the Fowler Independent Telephone Company.

COLVILLE, WASH.—The Pioneer Telephone Company a volunteer association, has petitioned the county commissioners of Stevens County Wash., for a franchise to use a portion of the Joe Martin road for the construction and maintenance of a telephone line.

PORTLAND, ORE.—The way was cleared for the reorganization and further expansion of the Home Telephone Company of Portland when Federal Judge Wolverton granted an application for receivership. The action is friendly, and is a technical step necessary to put the company on a financially sound basis.

OROSI, CAL.—The Orosi Farmers Telephone Company has reorganized and under the direction of J. W. McPherson V. E. Sloan, F. E. Cook, G. Reynolds and C. A. Evans, about $4000 will be spent in rebuilding the lines. Besides the lines to be constructed connection will be made with a number of private lines into new districts east of Orosi.

SOCORRO, N. M.—The Mountain States Telephone Company is planning to run new lines south of Albuquerque, the present plan to give Socorro two circuits. Manager I. Sparks states that the material is now on hand for the reconstruction and removal of the local exchange into its new quarters on Park street and Garfield avenue.

EVERETT, WASH.—The Washington Coast Utilities, a corporation, has presented a petition to the county commissioners of Snohomish County, Wash, for a grant of a franchise to construct, maintain, etc., poles and wires for transmission of electric current for telephone and telegraph purposes along certain county roads.

IRRIGATION

LASSEN, CAL.—It is reported that an irrigation scheme is under way whereby the high land of the valley, not reached by the other systems, may have water. McCoy Flat is the source of this system which is being pomoted by Scott McArthur and Geo. A. Long.

FAIRVIEW, CAL.—The dam of the Price Irrigation Company, 12 miles from here is a total loss. All fears that there would be loss of life in the towns of Schofield, Helper, Castle Gate and Colton, in the path of the 11,000 ft. of water that were released in the break were dispelled with an announcement by the Rio Grande Railroad that its force of men, assisted by workers of the irrigation company, had taken hundreds of men, women and children to safety.

EDISON
STORAGE BATTERIES
LONG LIFE — LIGHT WEIGHT
Reliability
90 per cent of the Warehouse and Baggage Trucks, Electric Street Trucks, Storage Battery Tractors and Mining Locomotives on the Pacific Coast are equipped with EDISON STORAGE BATTERIES.
EDISON STORAGE BATTERY SUPPLY CO.
San Francisco — Los Angeles — Seattle

Victor
Number 5090
—the New Insulator Design
for 60,000 volts
This is one of ten new and improved insulator designs for different voltages that have put a new meaning into insulator strength.
For your reference library we have prepared a supplement to "The Insulator Book."
It definitely points out the advantages secured through these much-needed improvements in design and construction.
Write us for your copy before it slips your mind.

The Locke Insulator Mfg. Co. Victor N.Y.